

TM 5-3805-246-12

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

**OPERATOR AND
ORGANIZATIONAL
MAINTENANCE MANUAL**

**GRADER, ROAD, MOTORIZED
DIESEL ENGINE DRIVEN**

12 FOOT BLADE

(CATERPILLAR MODEL 112F)

FSN 3805-902-3083

W/ MARTIN GS55 GRADERSCRAPER

FSN 3805-900-8545

CHANGE }
No. 1 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, 30 May

**Operator and Organizational
Maintenance Manual
Grader, Road, Motorized:
Diesel Engine Driven;**

**12 FOOT BLADE (CATERPILLAR MODEL 1
FSN 3805-902-3083
AND
MARTIN GS55 GRADER SCRAPER
FSN 3830-900-8545**

TM 5-3805-246-12, 22 April 1968, is changed as follows:
The title is changed as shown above.

Page 3. Appendix B title is changed as follows: "Basic
Items List and Items Troop Installed or Authorized."

Page 47. Delete paragraph: "Sometimes moisture, *
burn. Use care with fire."

Page 56. Delete paragraph: "washing the crankcase: *
the engine."

Page B-1. Appendix B, Basic Issue Items List is super-
fluous:

**APPENDIX B
BASIC ISSUE ITEMS LIST AND ITEMS
TROOP INSTALLED OR AUTHORIZED**

Section I. INTRODUCTION

B-1. Scope

This appendix lists basic issue items, items troop in-
stalled, authorized which accompany the motor grader, and are
used by the crew/operator for operation, installation, or

B-2. General

This basic issue items, items troop installed or authorized list is divided into the following sections:

a. Basic Issue Items List—Section II. A list, in alphabetical sequence, of items which are furnished with and which must be turned in with the end item.

b. Items Troop Installed or Authorized List—Section III. A list, in alphabetical sequence of items which at the discretion of the unit commander may accompany the end item, but are NOT subject to be turned in with the end item.

B-3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items List, Section II, and Items Troop Installed or Authorized, Section III.

a. Source, Maintenance, and Recoverability Code(s) (SMR):

(1) Source code, indicates the source for the listed item. Source codes are:

Code	Explanation
P	Repair parts, special tools and test equipment supplied from GSA/DSA or Army supply system and authorized for use at indicated maintenance levels.
P2.....	Repair parts, special tools and test equipment which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.

(2) Maintenance code, indicates the lowest level of maintenance authorized to install the listed item. The maintenance level code is:

Code	Explanation
C	Crew/Operator

(3) Recoverability code, indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are nonrecoverable. Recoverability codes are:

Code	Explanation
R	Applied to repair parts (assemblies and components), special tools and test equipment which are considered economically repairable at direct and general support maintenance levels.
S	Repair parts, special tools, test equipment and assemblies which

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required.

d. Unit of Measure (U/M). A 2-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. Quantity Furnished with Equipment (BIIL ONLY). This column indicates the quantity of an item furnished with the equipment.

f. Quantity Authorized (Items Troop Installed or Authorized Only). This column indicates the quantity of the item authorized to be used with the equipment.

g. Illustration (BIIL Only). This column is divided as follows:

(1) Figure number. Indicates the figure number of the illustration in which the item is shown.

(2) Item number. Indicates the callout number used to reference the item in the illustration.

SECTION II. BASIC ISSUE ITEMS LIST

(1)	(2)	(3)		(4)	(5)	(6)	
SMR code	Federal stock number	Description		Unit of meas	Qty furn with equip	Illustration	
		Ref No. & mfr code	Usable on code			(A) fig No.	(B) item No.
	5120-240-8703	ADAPTER ¾" ½"		EA	2		
		8H8576 (11083)					
	5120-224-1389	BAR PINCH		EA	2		
		5F4764 (11083)					
	2815-460-6235	EYE, LIFT		EA	2		
		3R1938					
	5120-293-0887	HAMMER, SLEDGE		EA	2		
	5120-652-3665	HANDLE ¾"		EA	2		
		8H8547 (11083)					
	5120-293-0987	HEAD, RATCHET ¾"		EA	2		
		8H8545 (11083)					
	5315-682-1597	PIN, SHEAR		EA	2		
		2D5511 (11083)					
	5110-595-9490	PLIERS		EA	2		
		2R8497 (11083)					
	5120-240-5364	RATCHET ¾"		EA	2		

SECTION II. BASIC ISSUE ITEMS LIST

(1) SMR code	(2) Federal stock number	(3) Description Ref No. & mfr code Usable on code		(4) Unit of meas	(5) Qty furn with equip	(6) Illustration	
						(A) fig No.	(B) item No.
	5120-020-2360	SCREWDRIVER 9842 (93389)		EA	2		
	5120-189-7932	SOCKET 9/16" 8H8549 (11083)		EA	2		
	5120-189-7985	SOCKET 3/4" 8H8552 (11083)		EA	2		
	5120-242-3354	SOCKET 7/16" 8H8562 (11083)		EA	2		
	5120-189-7935	SOCKET 15/16" 8H8555 (11083)		EA	2		
	5120-239-0021	SOCKET 1 1/8" 8H8534 (11083)		EA	2		
	5120-232-5681	SOCKET 1-5/16" 8H8536 (11083)		EA	2		
	5120-228-9505	WRENCH COMBINATION 7/16" 8H8506 (11083)		EA	2		
	5120-228-9507	WRENCH COMBINATION 9/16" 8H8508 (11083)		EA	2		
	5120-228-9510	WRENCH COMBINATION 3/4" 8H8511 (11083)		EA	2		
	5120-228-9513	WRENCH COMBINATION 1-1/16" 8H8514 (11083)		EA	2		
	5120-228-9515	WRENCH COMBINATION 1-1/16" 8H8516 (11083)		EA	2		
	5120-228-9516	WRENCH COMBINATION 1 1/8" 8H8517 (11083)		EA	2		
	5120-228-9518	WRENCH COMBINATION 1-5/16"		EA	2		

(1) SMR code	(2) Federal stock number	(3) Description Ref No. & mfr code	(4) Unit of meas	(5) Qty auth
	4210-889-2221	EXTINGUISHER, FIRE	EA	1

Page C-12. Line item 0301, column (3) H is changed as follows:
"O".

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:

VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25B, (qty rqr block No.
04) Organizational maintenance requirements for Earth Moving Equipment:
Graders.

GPO 824-544

SAFETY PRECAUTIONS

Before Operation

Always assume a safe position when inflating a tire to avoid the possibility of personal injury, should the tire fail or the locking ring be forced from the rim.

When handling fuel, always provide a metal-to-metal contact between the container and the tank. This will prevent a spark from being generated as fuel flows over the metallic surfaces.

Look in the intended direction of travel to make sure there are no personnel or obstructions in the way before moving the grader. Make sure the grader has sufficient clearance.

When using jacks to lift parts of the grader, be sure they rest on solid footing and use wooden blocks above the jacks to prevent slipping.

Stand clear of machinery when lifting heavy parts to prevent injury if the lifting device should fail.

During Operation

Never attempt to clean, oil, or adjust a machine while it is in motion.

Keep transmission gears and clutch engaged when traveling down a steep grade.

Do not make sharp turns at high speeds.

Do not operate the engine in an enclosed area without proper ventilation or an exhaust connection to the outside. Exhaust gases contain carbon monoxide, a colorless, odorless, and poisonous gas.

Do not turn disconnect switch OFF while the engine is running or damage to the generator, voltage regulator, and lights may result.

During Operation (Cont'd)

Use extreme caution in removing the radiator cap from an overheated engine. Do not add water to an overheated engine as there is danger of damage to the radiator, or of cracking the engine block.

Check load capacities on any bridge before crossing. Make sure the bridge will support 15 tons.

Apply brakes and engage clutch carefully. Sudden engagement of clutch or application of brakes causes undue strain on the grader.

Never shift gears from forward to reverse without stopping the grader.

Block wheels and set parking brake before attempting to change a flat tire.

After Operation

Before dismounting from the road grader, lower blade or graderscraper, place the gearshift lever in a neutral position and set the emergency (hand) brake.

When using jacks to lift parts of the grader, be sure they rest on solid footing and use wood blocks above the jacks to prevent slipping.

Always report any mechanical deficiencies that may result in damage to the grader if operation is continued.

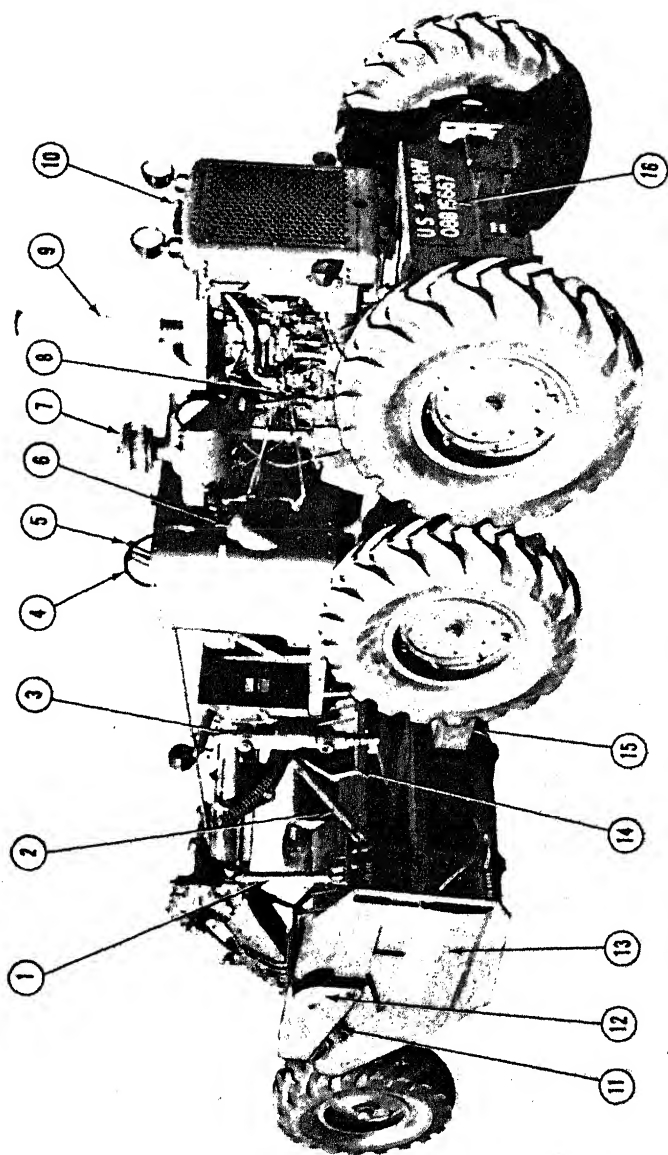
TM 5-3805-246-12

TECHNICAL MANUAL

NO. 5-3805-246-12

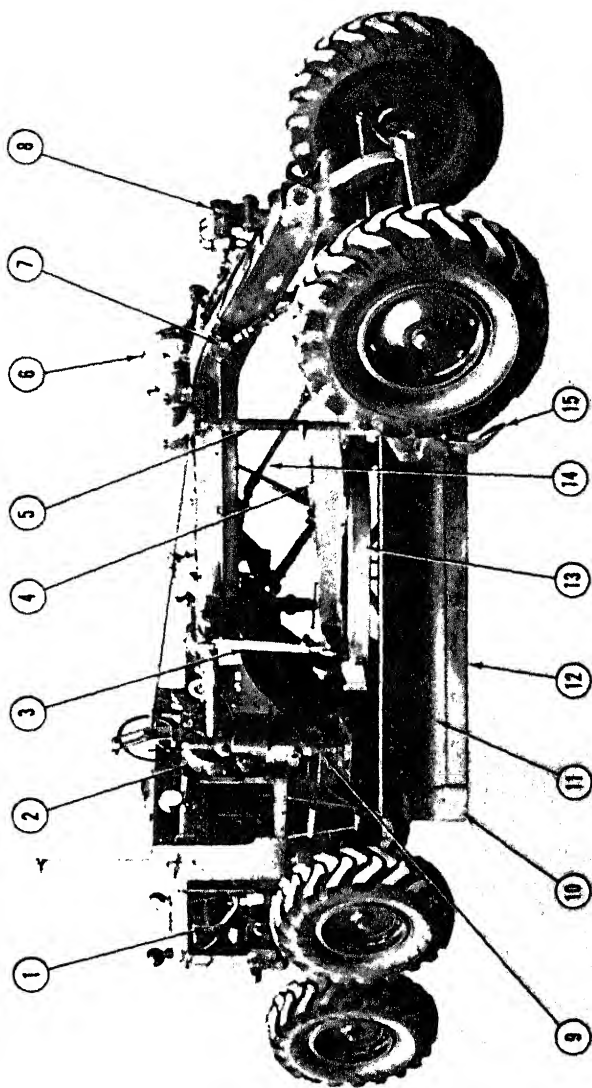
HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 22 April 1968OPERATOR AND ORGANIZATIONAL
MAINTENANCE MANUALGRADER, ROAD, MOTORIZED DIESEL ENGINE DRIVEN,
12 FOOT BLADE (CATERPILLAR MODEL 112F) FSN 3805-902-3083
W/MARTIN GS55 GRADERSCRAPER FSN 3805-900-8545

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C Maintenance Allocation Chart -----	C-1



LEFT-REAR THREE-QUARTER VIEW OF MODEL NO. 112F MOTOR GRADER EQUIPPED WITH GRADERSCRAPER.

- 1-Graderscraper lift link arm.
- 2-Graderscraper side shift line arm.
- 3-Leveling jack.
- 4-Ejector hydraulic control lever.
- 5-Apron hydraulic control lever.
- 6-Diesel fuel tank filler.
- 7-Diesel engine pre-cleaner.
- 8-Diesel engine starting engine.
- 9-Diesel engine exhaust stack.
- 10-Radiator filler cap.
- 11-Apron hydraulic actuating cylinder.
- 12-Apron.
- 13-Graderscraper.
- 14-Graderscraper.
- 15-Graderscraper.
- 16-Graderscraper.



RIGHT-FRONT THREE-QUARTER VIEW OF MODEL NO. 112F MOTOR GRADER
EQUIPPED WITH BLADE AND SCARIFIER.

- 1-Diesel engine crankcase breather and filler cap. 2-Blade lift control.
3-Blade lift link assembly. 4-Circle reverse control. 5-Scarifier lift link assembly.
6-Scarifier lift control. 7-Front wheel lever bezel pinion housing. 8-Steering gear assembly.
9-Leveling jack. 10-End bit. 11-Moldboard. 12-Cutting edge. 13-Circle. 14-Circle.
15-Scarifier.

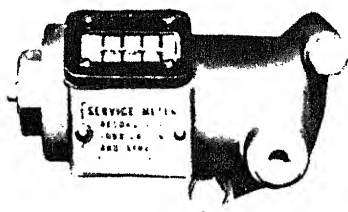
Lubrication Instructions

SERVICE METER

The Service Meter is located at the right side of the engine below the fuel filter housing.

It is geared to the engine, and when the crankshaft turns as many revolutions as are made in an hour at average operating speeds on an average job application, the dial advances one number. There are some applications that will result in either a lower or higher than normal average engine speed. Under this condition, the advance in the Service Meter reading will differ from the number of clock hours of operation.

The purpose of the Service Meter is to indicate when to perform the recommended maintenance and lubrication operations. The established intervals in the lubrication chart and maintenance instructions are given in service hours, so daily readings will tell when to service the motor grader. Rely on the Service Meter and not on the clock to measure service intervals.



SERVICE METER

T 6 0 2 2 0

GENERAL LUBRICATING INFORMATION

Naturally, any precautions taken during cold weather to house the motor grader, cover it with a tarpaulin, or warm it before starting, will cause more rapid oil distribution.

Lubricate all miscellaneous points not equipped with fittings with

Careful attention was given to the design of the hydraulic system to guard against oil leaks. Connections were eliminated where possible and metal to metal joints, with rubber ring seals, are used instead of the usual pipe thread joints. Oil leaks should not be neglected as the loss of oil is an unnecessary expense as well as a possible cause of damage to the hydraulic system.

It is extremely important in handling the oil to keep it clean. Every precaution should be taken to use only clean filler cans and to be sure that all dirt is removed from the filler cap before it is taken off for filling. The operator should take every precaution to prevent dirt from getting into any system to extend the life of the motor grader.

Careful attention to the following information on lubricants and their proper selection will add much to performance, economy and long life of your motor grader. **L0 5-3805-246-12** specifies the lubricants to be used, the points to be serviced and the intervals of servicing according to service hours.

DESCRIPTION OF LUBRICANTS

The lubricants recommended for use in this motor grader can be identified by the sub-headings preceding their descriptions that follow: The proper selection of one of these types of crankcase lubricating oils, and grade of oils can be made from the information in the topic **TYPE OF LUBRICANTS AND SAE GRADES TO USE and lubrication order - L0 5-3805-246-12.**

Crankcase Lubricating Oils

OE, OES Lubricants: These are additive-type oils that have been identified as meeting a rigid, high quality standard and certified for use in Diesel Engines See **lubrication order - L0 5-3805-246-12** for oils conforming to this specification.

Ball and Roller Bearing Lubricant. This lubricant is a mixture of mineral oil and metallic soaps. **Use GAA for all temperatures.**

This grease can be applied to all bearing points — plain bearings, ball bearings and roller bearings — where equipped with hydraulic pressure fittings or when bearings are hand packed.

Use only a high grade short fiber grease. This grease must be satisfactory in anti-friction bearings at speeds up to 3000 RPM at a maximum temperature of 300° F. It is a grease with sufficient adhesive qualities to cling to the bearings in all extremes of high and low operating temperatures (see L0 5-3805-246-12).

Type of Lubricants and Grades to Use

The grade of oil is classified in terms of viscosity (fluidity or flow ability) and is identified by OE, OES, GO, and GOS. OES and GOS are more fluid and flow more readily than OE and GO oils.

To determine if the oil in the compartments will flow in cold weather, remove the oil level gauge or dip a finger or clean rod into the oil before starting and if the oil will flow off, the oil is fluid enough to circulate properly.

The GOS oil used for cold weather operations should be drained and replaced with GO oil at the end of the cold season (see L0 5-3805-246-12).

The oil specification chart will aid in the proper oil grade selection for the various compartments. The proper grade of oil to select is determined by the atmospheric temperature at which the machine is started. However, during operation OES oil can be used successfully in the diesel engine crankcase when atmospheric temperatures are as high as 70° F.

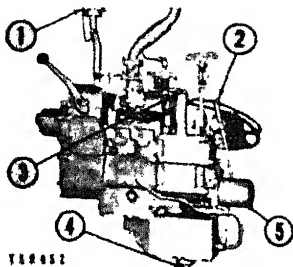
Diesel Engine Crankcase Lubricating Oil Change Periods

The crankcase lubricating oil change periods for these engines have been carefully established for the purpose of protecting the service life of the engine as economically as possible (see L0 5-3805-246-12).

Change the oil and filter element after the first 10 service hours of operation of a reconditioned engine.

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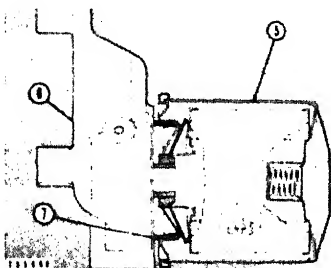
STARTING ENGINE CRANKCASE



Starting engines with separate lubrication systems can be identified by the separate breather and oil filler opening, the crankcase oil level gauge and the redesigned crankcase oil pan with drain.

Check oil level every 10 service hours. Oil should be up to "full" mark on the gauge (2). Every 125 to 250 service hours, depending on dust conditions, drain crankcase at (4) and clean the magnetic drain plug. When draining, engine must be level so all the oil in starting engine will drain. Wash breather (1) with kerosene at each oil change period. Refill crankcase at (3) to "full" mark on gauge. Start and run starting engine at least one minute, stop the engine, check the oil level and add oil if necessary to bring oil level up to "full" mark on gauge.

(see LO 5-3805-246-12)



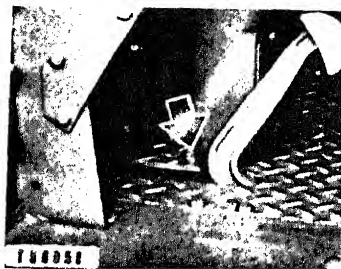
Every 500 service hours replace oil filter (5) with a new filter. On a new or reconditioned starting engine, the filter should be changed after 10 service hours or at the first time the diesel engine crankcase filter element is changed; whichever occurs first.

Remove filter (5) from the filter base (6) by turning the filter counterclockwise. Clean the mounting surface of the filter base. Be sure the gasket (7) is seated properly in the end of the new filter and apply a film of clean oil on the gasket. Install the new filter by turning it clockwise. Tighten the filter by turning it one turn, or to a torque of 8 to 10 pounds feet, after the filter gasket first contacts base (6). Appropriate wrenches are available

for this purpose. Do not overtighten the filter, otherwise damage may result to the gasket which could result in oil leakage.

GO LUBRICANT

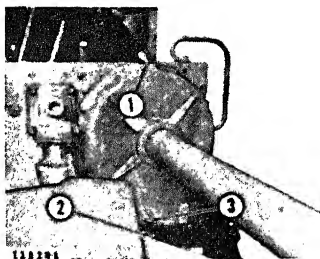
POWER CONTROL SHAFT WORM AND GEAR HOUSING



Check oil level in filler elbow every 100 service hours. Oil should be only visible in elbow. Drain, wash and fill to filler elbow every 1000 service hours. See the topic, "Washing Gear Compartments."

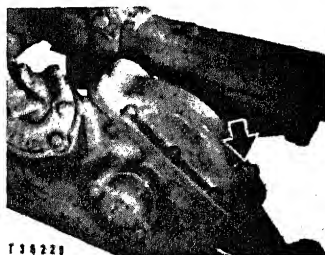
BLADE LIFT CONTROL HOUSINGS

Check oil level at plug (3) in each housing every 100 service hours. Drain at (2), wash and refill housing at (1) every 1000 service hours. See the topic "Washing Gear Compartments."



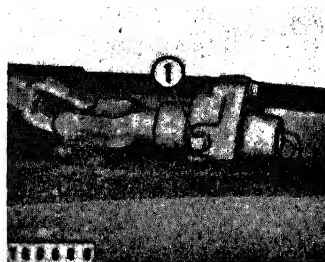
FRONT WHEEL LEAN CONTROL HOUSING

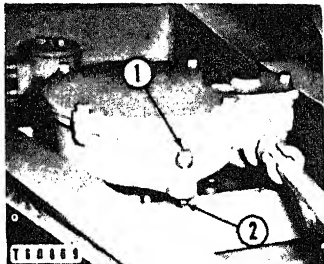
Check oil level at filter plug every 100 service hours. Fill if necessary.



TRANSFER GEAR HOUSING

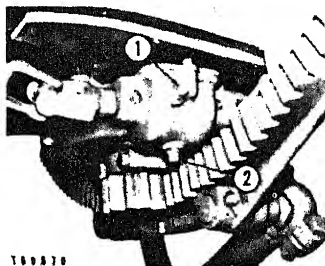
Check oil level at (1) every 100 service hours. Fill if necessary.





CIRCLE REVERSE CONTROL HOUSING

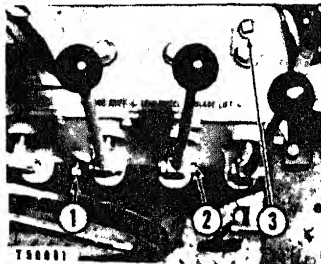
Check oil level at (1) every 100 service hours. Drain every 1000 service hours at (2). Wash and refill to filler opening at (1). See the topic, "Washing Gear Compartments."



CIRCLE CENTER SHIFT CONTROL HOUSING

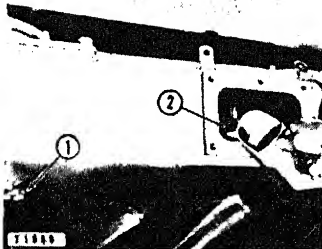
Check oil level at filler opening (1) every 125 service hours.

Drain at (2), wash and refill to filler opening every 1000 service hours. See the topic "Washing Gear Compartments."



POWER CONTROL HOUSING

Check oil level at (1), every 100 service hours. Drain housing at (2), wash and refill at (3) to level of plug hole (1) every 1000 service hours. See the topic, "Washing Gear Compartments."



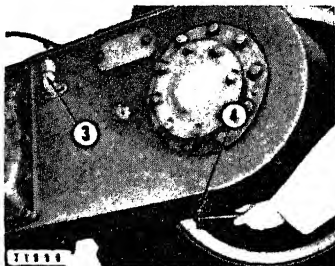
TANDEM DRIVE HOUSINGS

Check the oil level at (1) in each housing every 100 service hours. Replenish oil at (2).

GO LUBRICANT

TANDEM DRIVE HOUSINGS

Drain housing at (4), wash and refill it every 1000 service hours. Drain plug, for tandem drive housing opposite the one shown, is located on the other end of housing. See Note B to service breather (3). See the topic, "Washing Gear Compartments."

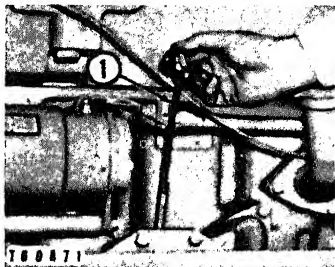


OE LUBRICANT

DIESEL ENGINE CRANKCASE

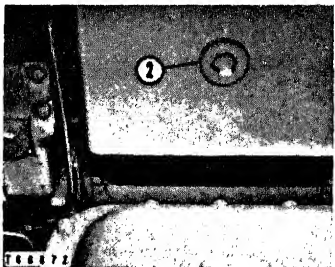
Every 10 service hours check oil level with the engine running. A guard to protect the gauge from spray makes it possible to do this. Always check the oil level when hot, with the engine running at low idle speed and the engine in a level position. Oil level should be between the "full" and "add oil" marks on gauge (1). Add oil when the oil level falls to the "add oil" mark. Do not overfill. For recommended lubricants see the topic "Description of Lubricants."

The oil level may be considerably higher than the "full" mark on the gauge if the full capacity of crankcase oil is checked after the engine has been stopped for several minutes.



DIESEL ENGINE CRANKCASE

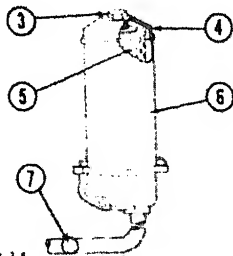
Drain crankcase at (2) with the motor grader level and while the engine is hot. See the topics, "Description of Lubricants" and "Diesel Engine Crankcase Lubricating Oil Change Period Chart." See Note C.



NOTE B: Every 250 service hours remove breathers for tandem drives, wash and put several drops of crankcase oil in breather cap and install.

NOTE C: Diesel Engines are built in a clean modern diesel engine factory and each crankcase is filled with a good quality of new crankcase oil. For these reasons the initial crankcase oil change period for this engine should be at the usual

OE LUBRICANT

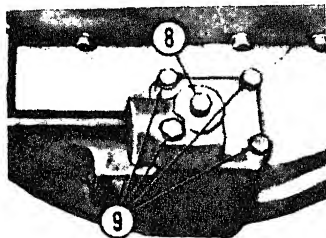


T 6 8 8 7 6

DIESEL ENGINE CRANKCASE LUBRICATING OIL FILTER

Every 250 service hours or less

drain the oil filter housing and replace the element with a new element. Remove the drain plug (7), cover screw (3), and cover (4). Remove the element (5) from the housing (6) and install the new element. Clean and install the drain plug and the cover. Run the engine for two minutes, then add oil to bring level to full mark on gauge.

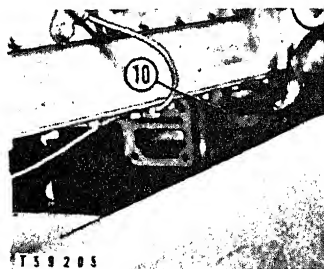


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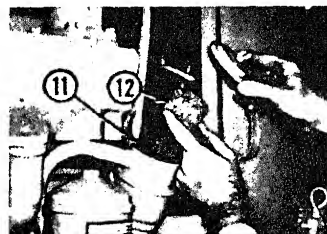
FLYWHEEL CLUTCH COMPARTMENT

Turn drain plug (8) counterclockwise to drain the flywheel clutch compartment each time the diesel engine crankcase is drained.

Every 1000 service hours remove four bolts (9) and clean screen (10).



T 5 9 2 0 5



DIESEL ENGINE CRANKCASE

After draining crankcase, oil filter, housing and clutch compartments, replace drain plugs and refill crankcase at (11) with approximately 18 quarts of oil. Run engine for two minutes then add oil to bring level to full mark on gauge while engine is running.

TRANSMISSION AND REAR AXLE HOUSING

Check oil level in the transmission and rear axle housings every 100 service hours at filler opening (1). Oil level should be up to the filler opening.

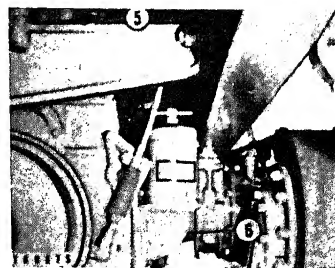
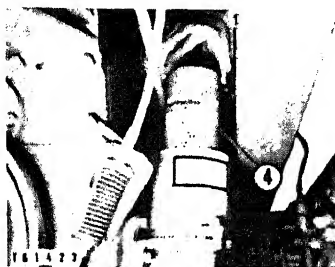
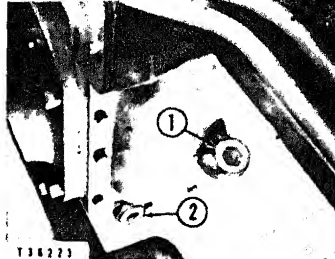
Check transmission oil filter element (4) every 125 service hours. It is advisable to replace the element with a new element when excessive sludging of the element is observed or every 250 service hours whichever occurs first.

Every 250 service hours remove the transmission breather (3) wash and oil the breather element and install.

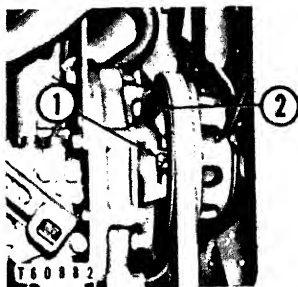
When extreme loads and high temperatures are encountered it may be necessary to change oil every 500 service hours. This can be determined by examining the oil on the oil level gauge and if it appears to be extremely thick and black the oil should be changed.

Every 1000 service hours drain the transmission case and rear axle housing by removing plug (2), from the back cover, the plug (5) in the left side of the transmission upper compartment, and the transmission filter base drain plug (6). Wash the compartments at each oil change period. See the topic, "Washing Gear Compartments."

Fill both the transmission and rear axle housing through the filler opening (1), with the engine running, the gear selector lever in neutral position and the high-low selector lever engaged. This will assure the proper lubricant level in the transmission upper compartment.

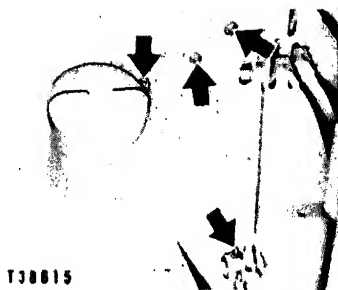


GAA LUBRICANT



FAN BEARING

Lubricate at fitting (1) every 250 service hours. Lubricate until grease appears at relief valve (2). Wipe off excess grease.

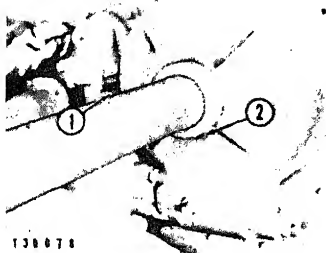
STARTING ENGINE CONTROL
LINKAGE BEARINGS

Lubricate the starting engine control linkage bearings every 10 service hours.

BRAKE CONTROL SHAFT, POWER
CONTROL DRIVE SHAFT SPLINE
AND ENGINE MOUNTING

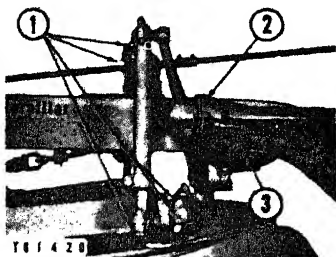
BLADE LIFT CONTROL SHAFT AND DRIVE PINION BEARINGS

Lubricate blade lift control shaft (2) and drive pinion bearings (1) on both sides of the machine every 10 service hours.



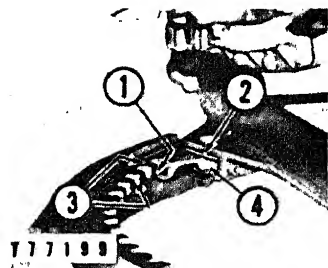
BALL AND SOCKET JOINTS, BLADE LIFT ARM SHAFT, AND CENTER SHIFT PINION SHAFT

Lubricate ball and socket joints (1), blade lift arm shaft bearings (2) and center shift pinion shaft at (3) every 10 service hours.



CIRCLE, GUIDE SHOES AND WEAR SPACERS

Before operating a new machine, then every 10 service hours apply lubricant with a paddle in front of and back of four guide shoes (4), on top and bottom of circle (3) and the ends of circle teeth (1). This will lubricate the bearing points at the four shoes and wear spacers (2).

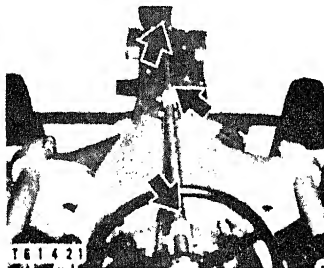


CIRCLE REVERSE DRIVE SHAFT BEARING

Lubricate bearing every 10 service hours.

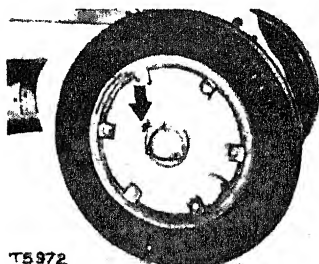


GAA LUBRICANT



STEERING CONTROL SHAFT BEARINGS

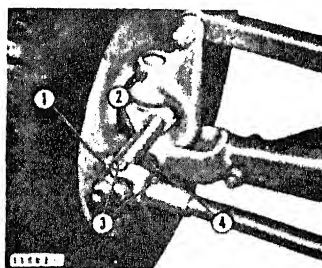
Lubricate shaft bearings every 10 service hours. (Three fittings.)



FRONT WHEEL BEARINGS

Lubricate every 125 service hours.

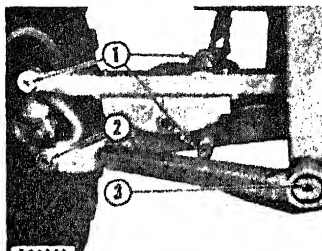
Every 6 months clean and relubricate bearings. Inspect seals and replace if damaged or worn.



TIE ROD FORK, STEERING ARM BLOCK, FRONT WHEEL LEAN PIVOT PIN AND STEERING KNUCKLE PIN

Lubricate tie rod fork at (3) and block at (1), front wheel lean pivot pin (4) and steering knuckle pin at (2), every 10 service hours.

Front wheel lean pins have a fitting in both the front and the rear of the pin.



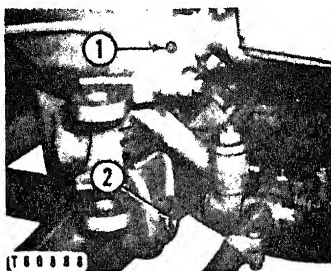
FRONT WHEEL LEAN RACK AND AXLE PIVOT PIN BEARINGS

Lubricate front wheel lean rack at (1), front wheel lean pin at (2) and axle pivot pin at (3), every 10 service hours.

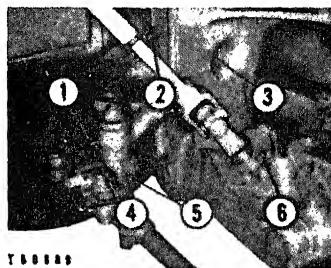
GAA LUBRICANT

CIRCLE DRAFT BALL JOINT AND
AXLE PIVOT PIN

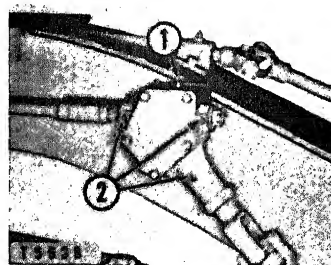
Lubricate circle draft ball joint (1) and axle pivot pin (2) every 10 service hours.

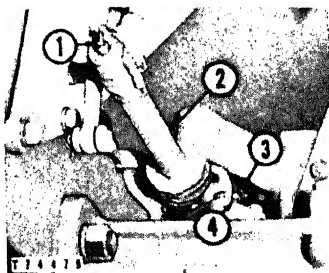
STEERING ARM, CIRCLE DRAFT
BALL JOINT, STEERING GEAR
SHAFT, TIE ROD ENDS, STEERING
ARM BLOCK AND FRONT WHEEL
LEAN CONTROL HOUSING
BEARING

Lubricate steering arm (1), circle draft ball joint (2), steering gear shaft (3), tie rod ends (4), steering arm block (5) and front wheel lean control housing bearing (6) every 10 service hours.

FRONT WHEEL LEAN SHAFT
AND BEVEL PINION HOUSING

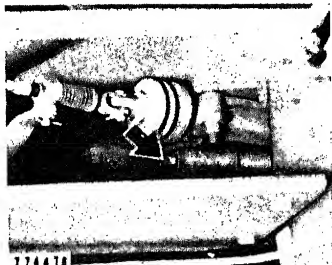
Lubricate front wheel lean shaft bearings through fittings (2) and fill housing through fitting (1) every 10 service hours.

HIGH-LOW SELECTOR
LEVER



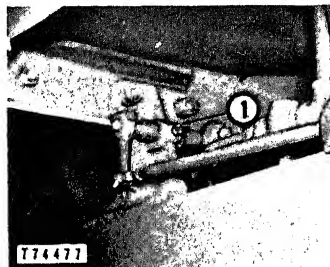
GEAR SELECTOR ROD ASSEMBLY

Lubricate gear selector rod pivot (2), yoke (3) front socket (1) and cross shaft bearing (4) every 10 service hours.



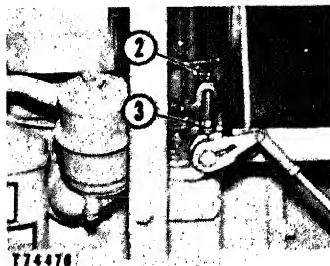
GEAR SELECTOR ROD ASSEMBLY

Lubricate rear socket bearing every 10 service hours.



GOVERNOR CONTROL LINKAGE BEARINGS

Lubricate bearing at (1) every 10 service hours.



GOVERNOR CONTROL LINKAGE BEARINGS

Lubricate bearing at (2) and (3) every 10 service hours.

GAA LUBRICANT

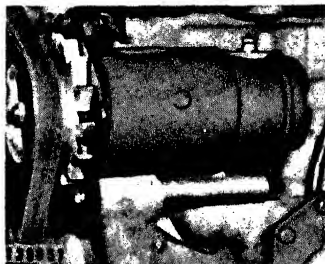
REAR AXLE HOUSING BRACKET CAPS

Lubricate two bearings every 10 service hours. One fitting on each side of the motor grader.



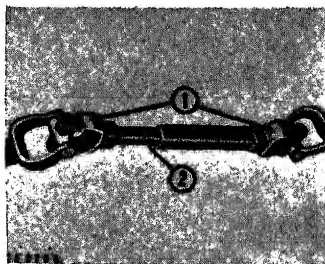
GENERATOR

Generators have bearings that require lubrication only every 2000 service hours, or when the generator is disassembled for cleaning or servicing. See the topic, "Generator."



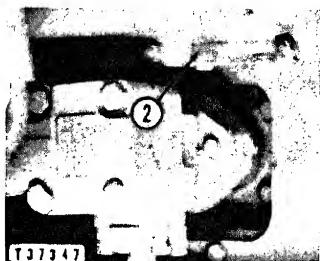
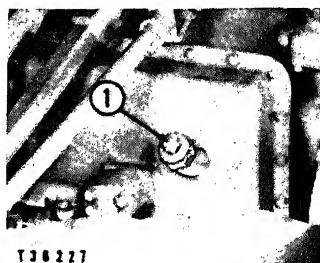
TELESCOPIC CONTROL SHAFTS

Every 50 service hours disconnect telescopic control shafts at the universal joint. Slide them apart and apply lubricant with a paddle at (2). Reassemble the universal joint fork (1) on each end of the shaft in the same plane (parallel to each other). If the shaft is assembled with the forks out of line it will whip or jerk.



Lubrication of Attachments

OE LUBRICANT



HYDRAULIC CONTROL SYSTEM

Check oil level every 10 service hours when the oil is warm. Clean dirt from around filler cap (1) and remove cap. Oil level should be visible in filler opening.

Every 1000 service hours, drain the hydraulic system. Position the motor grader and hydraulically controlled equipment so the cylinder pistons can move a complete stroke.

HYDRAULIC CONTROL SYSTEM

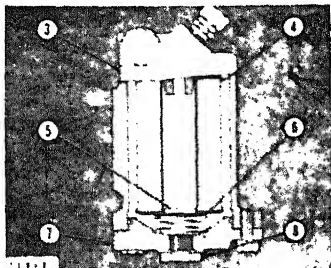
Stop the engine and remove the drain plug (2) to drain the system.

Before starting the engine, fill the hydraulic control tank to the top of the filler opening. Install the filler cap finger tight after filling. With the engine running at low idle speed, turn the steering wheel to extreme right and then to the left.

GO LUBRICANT

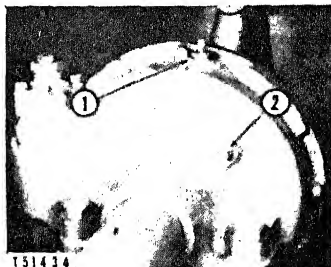
HYDRAULIC CONTROL
FILTER ELEMENT

To change the filter element, remove the drain plug (8) to drain the filter housing. Remove the base (7), spring (6), seat (5) and filter element (4) from the filter housing (3) and discard the element. Replace the cover and drain plug seals if damaged. Install the element, seat, spring and base being sure the element is piloted over the boss in the top of the filter housing.



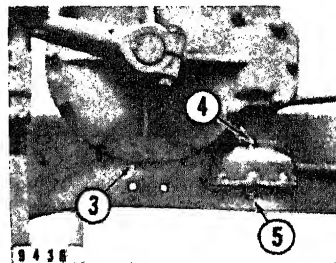
SCARIFIER CONTROL HOUSINGS

Check oil level at (2) every 125 service hours. Fill housing at (1).

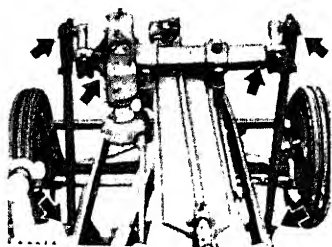


SCARIFIER CONTROL HOUSINGS

Drain housings every 1000 service hours by removing plugs (3), (4) and (5), wash and refill housings. To fill, replace plugs (3) and (5) and fill power control housing and reinstall plug at (4). Fill upper housing at (1).



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**SCARIFIER LIFT ARM AND
CONTROL SHAFT**

Lubricate bearings where fittings are provided every 10 service hours. Control shaft bearing is located on the left side of the frame just forward of the dash.

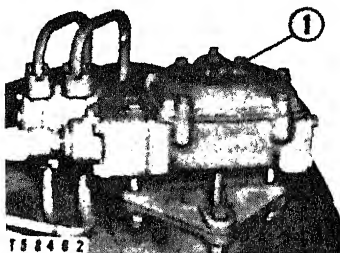
**POWER BLADE CYLINDER
ROD BEARING**

Lubricate the power blade cylinder rod bearing every 100 service hours. Apply grease from the grease gun only until resistance is

GO LUBRICANT

HYDRAULIC STEERING BOOSTER GEAR HOUSING

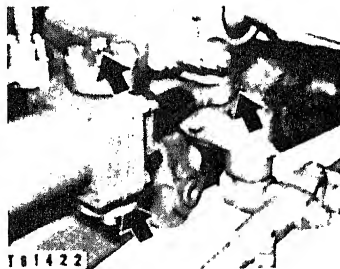
Every 100 service hours check lubricant level at filler opening (1) when wheels are turned full left or right. Lubricant level should be approximately $1\frac{1}{2}$ inches 38.1 (MM) below top of filler opening. The steering gear is packed at the time of assembly with a semi-fluid lubricant. When the lubricant level is low or when filling the gear after parts replacement



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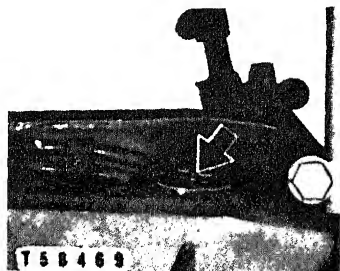
HYDRAULIC STEERING CYLINDER PIVOT BEARINGS AND STEERING ARM

Lubricate pivot bearings and steering arm every 10 service hours.



POWER BLADE HYDRAULIC LINES JUNCTION ASSEMBLY

Lubricate every 10 service hours with 2 or 3 strokes from the lever type grease gun.



PREPARATION FOR USE

New Motor Grader Initial Service: The first duty of anyone charged with the care and operation of a motor grader is to give it a detailed inspection, and to lubricate all parts as directed in the LUBRICATION INSTRUCTIONS section of this book.

Fill the diesel fuel tank, taking care no dirt, water, or other foreign substances are admitted with the fuel. Give particular attention to the details of fuel handling as outlined under the topic, CARE OF THE FUEL SUPPLY. Fill the starting engine fuel tank with gasoline.

Fill the cooling system with clean soft water and rust inhibitor, or with the correct anti-freeze solution if temperatures below freezing are likely to be encountered. See the topic, COOLING SYSTEM. Tires should be inflated to the correct pressures. See the topic, TIRES.

New Motor Grader Recheck: After the first 100 to 125 service hours of operation, tighten the diesel engine cylinder head bolts, the exhaust manifold, if the engine is turbocharged, tighten the turbocharger mounting stud nuts, and adjust the valves as described in the topic, DIESEL ENGINE VALVE CLEARANCE ADJUSTMENT. Tighten the starting engine head bolts and adjust the valves, as described in the topic, STARTING ENGINE VALVE CLEARANCE ADJUSTMENT.

New Operator's Responsibility: The operator who is given the responsibility of care and operation of a motor grader already in service, should first, check it for necessary lubrication, fuel supply and coolant in the radiator.

Second, the motor grader should have any necessary adjustments made to obtain satisfactory performance. Tire pressures should be maintained at the correct operating pressures. See the topic, TIRES.

Third, if the motor grader has been stored with oil in the cylinders, comply with the starting procedure under the topic, STORAGE.

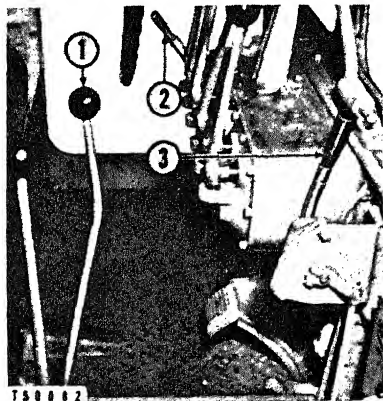
STARTING THE ENGINE

Before Starting: Check the diesel engine crankcase oil level to be sure it is considerably above the "add oil" mark on the gauge. The oil level in the hydraulic system, when so equipped, should be checked also to be sure the oil is visible in the filler opening.

1. Disengage the flywheel clutch by pressing the clutch pedal down as far as it will go.
2. Shift the gear selector lever (1) to the neutral position and pull the parking brake control lever (2) back to set the brake.

MOTOR GRADER CONTROLS IN START POSITION

1-Gear selector lever. 2-Parking brake
lever. 3-Governor control lever.



3. Move the governor control lever (3) to about half engine speed position.

Gasoline Engine Starting

The starting engine may be started manually or by means of the starting engine electric starter.

Helpful suggestions for starting the starting engine in cold weather are found in the topic, STARTING IN COLD WEATHER.

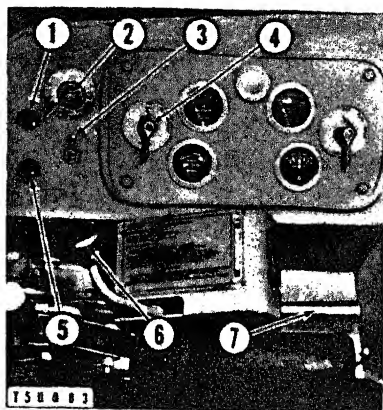
Position Controls for Starting: Before attempting to start the starting and diesel engines, the controls should be correctly positioned. See the topic, STARTING THE ENGINE.

1. Move the compression release control lever (6) forward to the start position.
2. Move the starting engine fuel valve (7) to the vertical position.
3. Pull out the starting engine choke control (4).
4. Push in the starting engine throttle control (3) to the $\frac{1}{4}$ to $\frac{1}{2}$ engine speed position.
5. Turn ON the disconnect switch (2).

CAUTION

Never open the disconnect switch when the engine is running or damage to the generator and lights may result.

Starting the Starting Engine: After positioning the controls correctly, the starting engine may be started as follows:

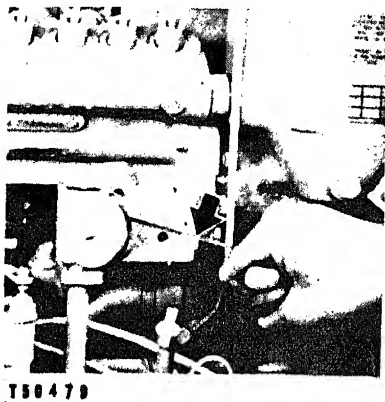


STARTING ENGINE CONTROLS

1-Throttle control. 2-Disconnect switch.
3-Fuel valve. 4-Run-start switch (magneto and electric starter). 5-Choke control. 6-Compression release lever. 7-Starting engine clutch and starter pinion control lever.

NOTE

To start the starting engine when the starter pinion has, for any reason, been engaged with the diesel: move the clutch and starter pinion control lever up **before** attempting to start the starting engine.



STARTING ENGINE RECOIL STARTER



3. Push in the choke control when the engine will run with the choke off. Temperature and altitude will vary the length of time it is necessary to have the choke on. Actual experience in starting will determine this interval.
4. Sometimes the starting engine can be started more quickly by pulling the throttle control out. **When the engine starts, push the throttle control in to keep the engine speed low until the crankcase lubricating oil has a chance to warm up and better lubricate the engine.**

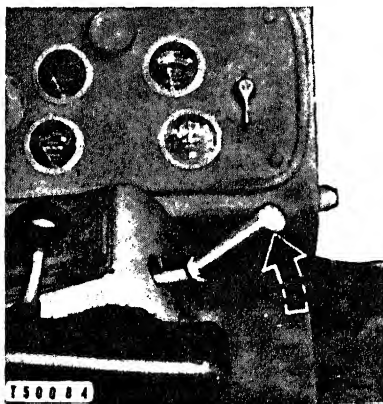
If it is necessary for any reason to start the starting engine manually, use the recoil starter cable. Grasp the handle and spin the starting engine with a quick pull of the cable. Allow the cable to rewind slowly.

CAUTION

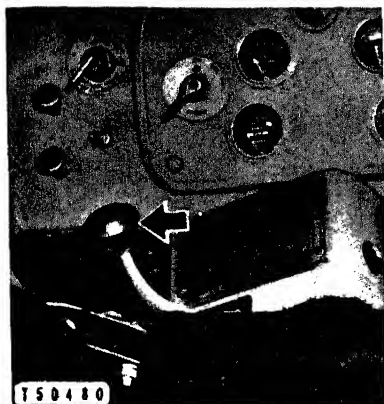
Before attempting to push start the motor grader be sure the clutch and starter pinion control lever is all the way down in the clutch engaged position.

Starting the Diesel Engine: The following steps should be carefully followed to prevent damage to the starter pinion or flywheel ring gear.

1. Push the throttle control in to let the starting engine run at full governed speed.
2. Move the clutch and starter pinion control lever upward as far as it will go to release the clutch, apply the clutch brake and engage the starter pinion. In cold weather, if the starter pinion clashes and will not engage with the diesel engine ring gear, see the topic STARTING IN COLD WEATHER.
3. Move the clutch and starter pinion control lever downward as far as it will go to engage the clutch.



4. If the engine slows to the stalling point when the clutch is engaged, as it might in cold weather, disengage the clutch and let the engine pick up speed again. See the topic, STARTING IN COLD WEATHER.
5. Move the compression release lever to the run position as soon as the starting engine is cranking the diesel engine at normal cranking speed.



**COMPRESSION RELEASE LEVER
IN RUN POSITION**



The heat generated when the starting engine is cranking the diesel engine against compression, and the circulation of the starting engine exhaust around the diesel engine air inlet pipe warms the cylinders, pistons, and combustion chambers to the starting temperature. Actual experience will determine the length of time necessary to crank the diesel engine to warm it sufficiently to assure easy starting.

6. Move the governor control lever (3) to half engine speed position.

If the diesel engine does not start after it has turned several revolutions, shut off the fuel supply by moving the governor control lever to the shut-off position to clear the cylinders of raw fuel, and let the starting engine turn the diesel engine against compression a little longer.

After the engine starts, reduce engine speed to low idle until the oil pressure gauge indicates normal oil pressure. Place the high-low selector lever in engaged position so the transmission oil pump will be in operation. When the gauge indicates normal oil pressure, the engine should be allowed to run for five minutes with the accelerator at approximately half speed position before applying the load. During this period the engine gauges should be observed for proper readings as explained in the topic, GAUGES.

diesel engine is running; this will enable the starter pinion to automatically disengage from the diesel engine ring gear.

If the diesel engine is thoroughly heated but does not start, see that everything is correctly set for starting. If smoke has been coming from the diesel engine exhaust pipe, fuel has been reaching the cylinders. If no smoke has been evident when governor control is in the half engine speed position, check the fuel supply. If the diesel fuel tank is empty, or if the fuel tank valve was closed, it will be necessary to prime the system as outlined under the topic, PRIMING THE FUEL SYSTEM. In case there may be water or dirt in the fuel system, or if the fuel injection equipment is suspected, see the topic, FUEL INJECTION EQUIPMENT.

7. Stop the starting engine by pushing the throttle control in so it will idle at low speed. Move the starting engine fuel valve to the horizontal position and allow the starting engine to burn all the fuel in the carburetor. Then turn OFF the RUN-START switch.

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GAUGES

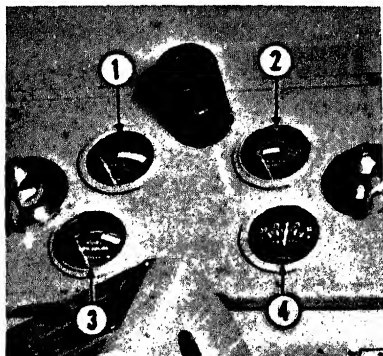
After the engine starts, and at frequent intervals while the engine is operating, the engine gauges should be observed for proper readings as explained in the following paragraphs:

Oil Pressure Gauge: Immediately after the engine has started, check the crankcase lubricating oil pressure gauge (1) to see that it is registering pressure. When the engine is running at rated engine speed the gauge should register in the OPERATING RANGE. A lower pressure reading is normal at low idling speeds. If no pressure is indicated, investigate at once.

Water Temperature Gauge: The indicator on the water temperature gauge (2) should register in the OPERATING RANGE. The water temperature regulators within the diesel engine cooling system are designed to give an approximate minimum coolant temperature of 160° F. (71° C.). The maximum operating temperature will vary according to the air temperature and load factor, but should never exceed boiling temperature at the prevailing altitude.

GAUGES

- 1-Crankcase lubricating oil pressure gauge. 2-Water temperature gauge.
3-Fuel pressure gauge. 4-Ammeter.



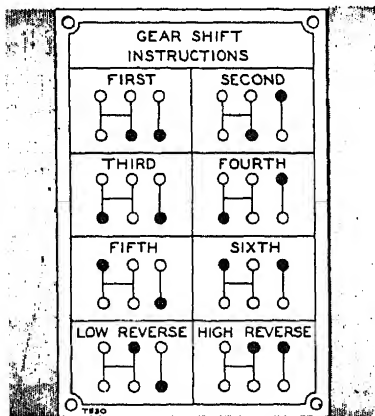
Ammeter: Check the ammeter (4) to see that the indicator is registering in the charging range (indicator on the + side of zero). If the indicator registers in the discharging range (indicator on the - side of zero) investigate at once. See the topic, GENERATOR REGULATOR.

Fuel Pressure Gauge: The indicator on the fuel pressure gauge (3) should register in the NORMAL (green) range. See the topic, CARE OF THE FUEL FILTER.

DRIVING THE MOTOR GRADER

Disengage the clutch by pressing the clutch pedal down as far as it will go. This downward pressure applies the clutch brake which stops the rotation of the transmission shaft and gears. The clutch pedal also controls the locking mechanism that holds the transmission sliding gears in position, so the gears can not be shifted into or out of mesh with the clutch engaged. Always shift the gears completely into mesh.

Gear selector lever positions illustrated here, is a plate located on the instrument panel. Refer to this instruction plate and correctly position the two gear selector levers for the desired direction and speed.



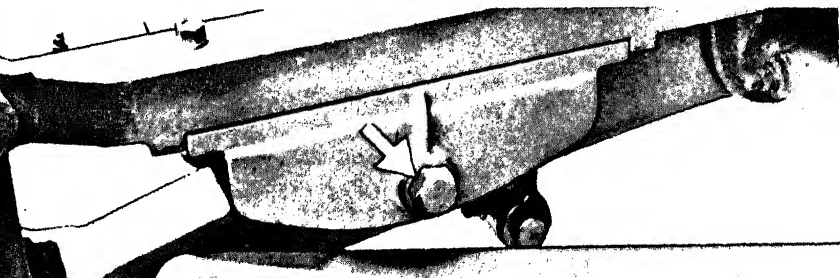
GEAR SELECTOR
POSITIONS



The high-low selector lever should always remain in engaged position when the diesel engine is running to properly lubricate the transmission.

Pull the governor control lever far enough back to obtain the desired travel speed. For maximum speed and power output this lever is pulled back all the way. Experienced operators can use to good advantage the higher working speeds obtained at full speed setting. However, for ordinary road maintenance or other jobs not requiring maximum power output, reduced engine speed may be preferable.

Front Wheel Lean: The front wheel lean rack is provided with a locking bolt to hold the wheels from creeping during shipment. This bolt **must be removed** before the wheel lean control lever is operated. It is never used in operating the machine, unless it is desired to lock the front wheels and use the wheel lean control to operate some front mounted equipment.



Most motor grader work places a side load on the machine, tending to push the front end sideways. Leaning the front wheels in the direction opposite to the force of this side thrust will counteract this force and hold the machine to its course.

Leaning front wheels are also helpful in turning the machine around. Lean the wheels all the way over in the direction of turn and **leave them in the same position** until the turn is completed.

Hydraulic Steering: With the hydraulic steering booster attachment installed on the motor grader the manual effort required to turn the wheels is greatly reduced. Whenever the engine is running, the pump will be operating and hydraulic pressure is available to aid in steering the motor grader. Greater pressures are developed at higher engine speeds so at these speeds more boost will be noticed than at lower engine speeds. Since there is a direct mechanical connection between the steering wheel and the front wheels of the motor grader it is not necessary that the engine be running to make it possible to steer the motor grader.

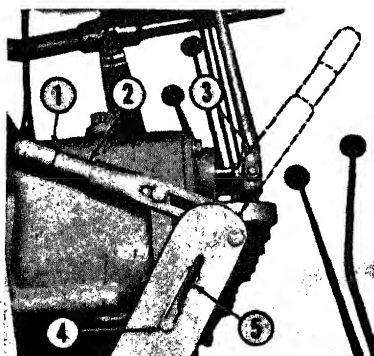
STOPPING THE MOTOR GRADER

For a temporary stop (to stop the motor grader and allow the engine to run), disengage the clutch and apply the brake if necessary. Disengage the transmission by moving the gear selector lever to the neutral position, the high-low selector lever must be either in the high or the low speed position. Engage the clutch and move the governor control lever to reduce engine speed.

Reduce engine speed as described in the topic, STOPPING THE DIESEL ENGINE.

PARKING BRAKE

The parking brake is located to the left of the operator and consists of control lever (2) connected to a cable which connects to a lever on the



PARKING BRAKE CONTROL LEVER

- 1-Adjusting knob. 2-Control lever.
3-Vertical position. 4-Pin. 5-Slot.

transmission brake cam. To engage the parking brake move the control lever back to the overcenter vertical position (3) thus pulling the cable up and holding the parking brake in the applied position. To release the parking brake, move the control lever forward.

Normal wear of the brake will result in the necessity for periodic adjustment. To adjust the parking brake, rotate the adjusting knob (1) of the control lever (2) clockwise until the lever has a distinct snap-over-center and will remain in the vertical position (2).

When the pin (4) is at the upper limit of its travel in the slot (5) and the lever will still not snap-over-center, further adjustment is needed. See the topic, PARKING BRAKE ADJUSTMENT.

STOPPING THE DIESEL ENGINE

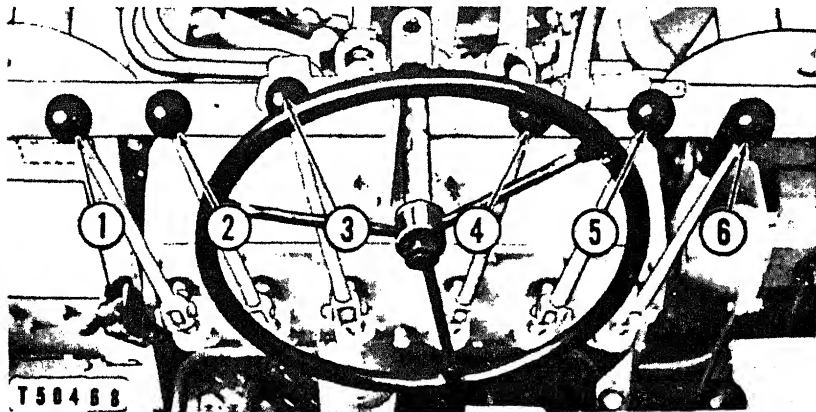
Correctly stopping the diesel engine will allow hot areas in the engine to gradually cool, thus extending engine service life. The correct diesel engine stopping procedure is as follows:

1. After the normal load is removed from the engine allow it to idle five minutes with the governor control lever at half engine speed position before stopping.
2. Reduce the engine speed to low idle for thirty seconds.
3. Stop the engine while it is running at low idle by moving the governor control lever to the SHUT-OFF position. Do not accelerate the engine speed above low idle before stopping the engine.

If the motor grader must stand without shelter, cover the diesel engine exhaust pipe (including starting engine exhaust pipe if so equipped) to exclude rain or snow. If the temperature is below freezing, or if freezing conditions are expected, the engine will be started again, check to

POWER CONTROLS

The power control clutch should be operated with a quick firm push or pull that will fully engage the jaws. Then hold the lever firmly in engagement to avoid kick-out and chatter. When the limit of travel is reached immediately disengage the lever.



POWER CONTROLS

1-Blade lift, left end. 2-Scarifier. 3-Circle reverse. 4-Side shift.
5-Front wheel lean. 6-Blade lift, right end.

Blade Lift: Push the control levers (1) and (6) forward to lower the blade. Pull the control levers back to raise the blade.

Levers may be operated separately so the blade is tipped at the best angle and then both operated at the same time to lower the blade to the working depth.

Side Shift: Push the control lever (4) forward to shift the circle to the left. Pull the control lever back to shift the circle to the right.

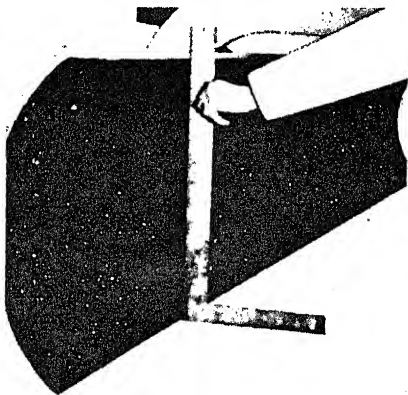
Circle Reverse: Push the control lever (3) forward to turn the circle counterclockwise (or to the left). Pull the control lever back to turn the circle clockwise (or to the right).

Front Wheel Lean: Push the control lever (5) forward to lean the wheels to the left. Pull the control lever back to lean the wheels to the right.

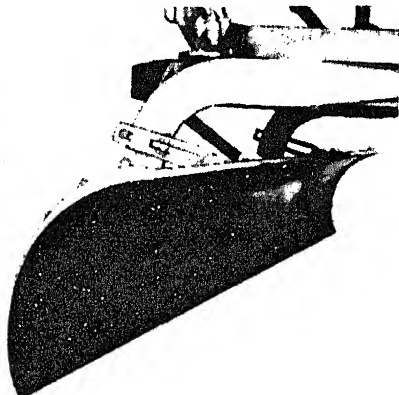
Scarifier: When the scarifier attachment is used, push the control lever (2) forward to lower the scarifier and pull back to raise it. Raise the blade when doing heavy scarifying. For light scarifying, the blade may be used at the same time the scarifying is being done.

BLADE PITCH POSITIONS

For Cutting Action: Loosen the bolts through the blade beams and the tilting links; then tilt the upper edge of the blade back until the top



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BLADE SET FOR CUTTING

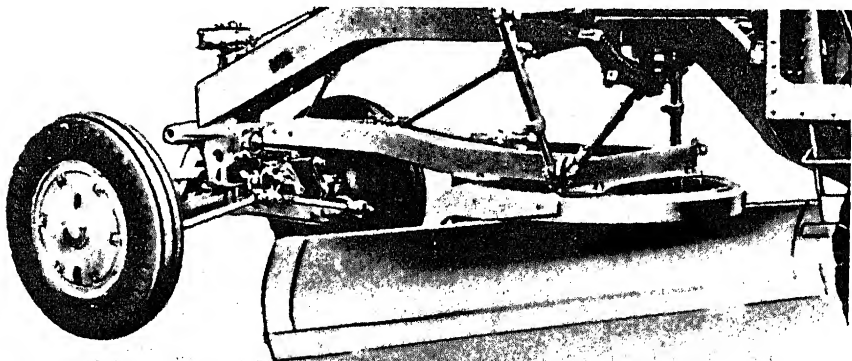
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BLADE SET FOR DRAGGING

For Dragging Action: Loosen the bolts through the blade beams and tilting links; then tilt the upper edge of the blade forward until the cutting edge is approximately perpendicular to the ground. Refer to the topic, **LIFT LINKS AND CENTER SHIFT LINK**.

REVERSING THE BLADE

Grading and maintaining may be accomplished in reverse gears by reversing the blade.



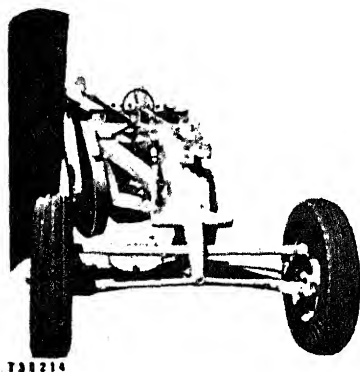
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Angular positions of the blade and blade pitch positions will be relatively the same for grading and maintaining in reverse as they would be for forward operations.

CUTTING BANKS

To reach a bank sloping position, rotate the circle to bring the blade at an angle of approximately 20° to the machine at the right side of the frame. Move the center shift to the right as the left side of the circle is lowered and the right side is raised. Continue to operate the controls until the desired position is reached.

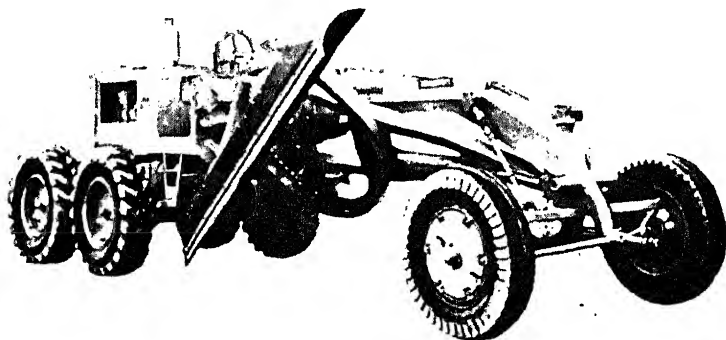
The blade should be set for cutting action, and the front wheels may be leaned as required to hold the machine against the load.



MOTOR GRADER SET
TO CUT BANKS



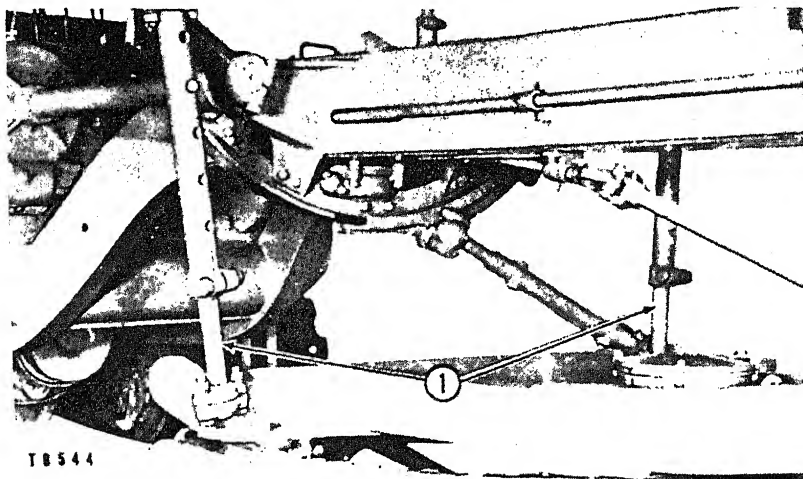
When making a turn at the end of the cut, the upper end of the blade may be tilted down and returned to its former position when the turn is completed, without stopping the motor grader.



LIFT LINKS

The lift links (1) are usually set with both links extended one hole from the top. This permits the blade to be placed in both ditching and right backsloping positions without changing the links.

For more extreme bank cuts it is necessary to further extend the left

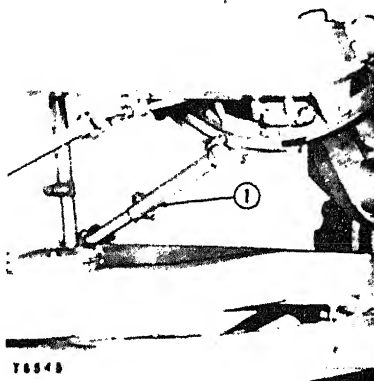


LIFT LINKS

1—Lift links.

CENTER SHIFT LINK

The center shift link (1) should always be attached to the center shift gear rack on the opposite side from which it is attached to the circle drawbar, and should always be in tension when placing the blade in bank cutting position. Unless it is desired to cut banks on the left side, the center shift link connections need never be changed. For left bank work it is necessary to reverse the center shift link (1) by connecting it to the left hole in the rack and to the right side of the circle assembly.



CENTER SHIFT LINK

1—Center shift link.



The center shift link has three length adjustments. For ordinary

finishing inside slopes, the center shift link can be extended to the longest position.

For surface maintenance or dragging operations it is also advisable to extend the center shift link as this gives greater rigidity to the blade.

DAILY CARE

Attention should be given to the operations mentioned in this topic every 10 service hours or daily, whichever occurs first.

A daily check of the motor grader should be made to see if there are any loose nuts, bolts, or parts worn to such an extent that they are no longer serviceable.

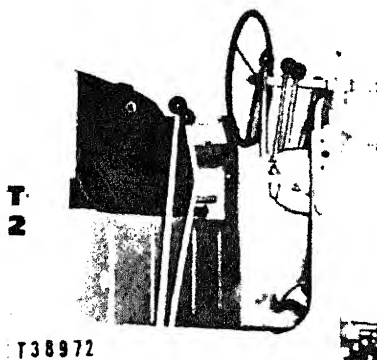
If corrective steps are taken immediately upon discovery of loose or worn parts, fewer forced stops and more economical operation will result. Points to be checked daily for tightness or leaks are listed as follows:

1. Gasketed joints of rear axle and tandem drive housings, inspect for tightness.
2. Exhaust manifold, air cleaner connections and turbocharger mounting stud nuts, if engine is so equipped, inspect for tightness.
3. Cooling system, clean trash from radiator core and add coolant or anti-freeze if necessary.
4. Fuel pressure gauge, inspect with engine running to see that indicator is not in red range.
5. Precleaner, inspect for dirt in the body when operating in extremely dusty conditions.
6. Turbocharger, check to see that no vibration or excessive noise is present. The "muffled high pitched whine" is the normal sound. If the turbocharger is defective it will usually be noisy only under load.
7. Tires, inspect for wear, cuts and for correct air pressure.
8. Hydraulic system and turbocharger oil supply inlet tube, inspect for leaks.

Dirt should not be allowed to accumulate on the machine. A few minutes spent daily in keeping it clean are well repaid in improved appearance, and greater ease and safety in operation and maintenance.

Fill the diesel fuel tank at the end of the day's run. See the topic: CARE OF THE DIESEL FUEL TANK for other periodic care.

When the diesel engine is operating continuously, the starting engine should be run for a few minutes each day to dissipate condensation and renew the oil film in the bearing surfaces and cylinder walls.



SEAT CUSHION TIPPED
TO PROTECT PADDING

If the motor grader must stand without shelter the operators seat cushion should be tipped as shown. When this is done the water proof covering prevents moisture entering the padding under the covering. If the cushion is turned bottom side up in rainy weather the padding under the water proof covering will become damp. This moisture with accumulated dirt and heat will shorten the life of the cushion.

STARTING IN COLD WEATHER

If the starting engine and the diesel engine are both in good mechanical condition, and the precautions necessary for cold weather operations are taken, ordinary cold weather will not cause difficulty in starting or loss of efficiency.

Lubricants: As the starting atmospheric temperatures become lower, where warm housing facilities are not available, lubricants of lower viscosity should be used. See the topic, TYPES OF LUBRICANTS AND SAE GRADES TO USE.

Coolant: When the temperature is below freezing, sufficient anti-freeze solution should be used in the cooling system to prevent freezing. See the topic, COOLING SYSTEM.

The liquid in the cooling system may be warmed to make starting easier and quicker. When warming anti-freeze solutions, keep away from flames, as some of these solutions may be inflammable. Avoid getting the solution hot, and even a warm solution should be poured very slowly into a cold cooling system to prevent damage by sudden expansion.

Fuel: Fuel must be "free flowing" enough to flow readily through the fuel lines at the lowest temperature at which the motor grader will be started and operated. For additional information on this subject, see the

given the condition of the battery. It should be tested frequently and charged as often as necessary to insure sufficient power for starting. All switches and connections in the electrical system should be inspected and kept in good condition to prevent losses through improper contacts. See the topic, BATTERY.

Hydraulic System: In temperatures below freezing, extra precaution should be taken to insure adequate pump lubrication. Before starting the engine, remove the filler cap on the hydraulic tank to relieve any vacuum which might be in the tank. Replace the filler cap. Do not allow the engine to run over half engine speed until after five minutes when the oil in the hydraulic system is warm. In temperatures below 10° F. dilute the oil in the hydraulic system to insure free circulation. See the topic, LUBRICATION INSTRUCTIONS.

Starting the Starting Engine: If the motor grader has been standing without shelter in extremely cold weather, the suggestions that follow will materially assist starting as well as protect the engine against damage.

Crank the starting engine several revolutions with the magneto switch OFF, and the starting engine clutch disengaged. This will better distribute oil to the bearings and cylinder walls.

Sometimes moisture, or fuel which has not vaporized, collects on the starting engine spark plugs. They may be dried out by removing them and pouring gasoline over the electrodes. Ignite the gasoline and allow it to burn. **Use care with fire.**

Pouring a small amount of gasoline on the electrodes before they are replaced in the engine is more effective in promoting combustion than priming the cylinders with gasoline. A small amount of raw gasoline in the cylinders will remove the film of oil from the cylinder walls and interfere with compression.

Sometimes the starting engine can be started more quickly by pulling out the throttle control. **When the engine starts push in the throttle to the idling position to keep the engine speed low until the crankcase lubricating oil has a chance to warm up and better lubricate the engine.**

Starting the Diesel Engine: It is very important to keep low viscosity crankcase lubricating oil above the ADD OIL mark on the gauge in the

In cold weather, if the starter pinion clashes and will not engage with the ring gear, proceed as follows:

1. Stop the starting engine after the lubricating oil is thoroughly warmed.
2. Engage the starter pinion by pulling the clutch and starter pinion control lever upward as far as it will go. (It may be necessary to rotate the starter pinion by the use of the electric starter or hand recoil starter.)
3. Restart the starting engine.
4. With the starting engine running at high idle speed, engage the starting engine clutch, by pushing the control lever downward to start the diesel engine.

OPERATION DURING HIGHWAY TRANSPORTATION

When driving the motor grader on highways a distance exceeding 50 miles, during a move from one job to another, the tire pressures used should be those listed in the chart, under the topic, TIRES.

Be sure to comply with all laws governing the movement of this type of equipment. These may vary between states, but never permit the machine to exceed a speed of 30 miles per hour.

While in transit do the following:

1. Check the gauges on the dash panel frequently.
2. Stop every 50 road miles for at least 30 minutes to inspect the machine. This will permit the tires, brakes, bearings and other parts to cool.
3. Lubricate the machine at recommended service hour intervals during transit.

STORAGE

Lubricate all points mentioned in the lubrication chart if the motor grader is to be stored or left standing for any length of time. This will protect against rusting.

Starting Engine and Diesel Engine: If the motor grader is to be stored or left standing for a long period of time, the lubricating oil may drain away from the cylinder walls and piston rings. This lack of lubricant permits the rings and liners to rust. It also permits unnecessary wear caused by metal-to-metal contact between the pistons, rings and liners when the engine is started before fresh oil has reached these surfaces. The lack of lubricant may not cause any noticeable change in engine operation after it has been started but it does contribute to shorter engine life.

engine and diesel engine until they are thoroughly warm. This will circulate the oil and prevent rusting from condensation.

Transmission and Rear Axle Housings: Drive the motor grader a short distance under its own power every 30 days to renew the oil film on shafts, gears, bearings and seals. If the motor grader cannot be moved, or if it has been blocked up for storage, the same result may be accomplished by shifting the transmission into gear while running the engine with the motor grader resting on blocks. Be sure the blocking is secure.

It is not necessary to operate until the transmission oil becomes warm, but ample time should be allowed for the oil to circulate thoroughly.

Power Controls: Operate the power control levers with the engine running every 30 days to circulate the oil in the control housings.

Blade: A coating of heavy grease should be applied to the front surface of the blade while it still retains its polish, to prevent rusting. See the topic, BLADE SURFACE.

Battery: Periods of two weeks or more when the engine is not operated necessitates provisions being made to keep the battery charged. This may be done by running the engine once a week or remove the battery for charging.

Cooling System: If the temperature will be below freezing, the cooling system should be drained if it has not been serviced as indicated in the topic, COOLING SYSTEM.

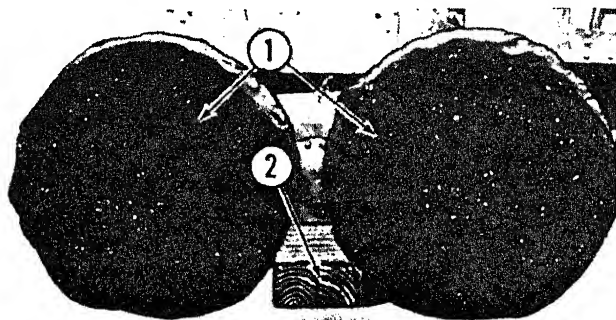
Tires: Tire service life can be greatly extended by using the proper storage practices. The proper storage methods are especially important during periods when machines are not being operated, particularly when these periods extend over two weeks in time.

Before extended storage, clean and carefully inspect all tire surfaces. Breaks or cuts should be repaired, especially those in which the underlayers of fabric are exposed. Moisture may be absorbed through these breaks and cause rapid deterioration during storage.

The factors which cause and accelerate tire deterioration during storage are: sunlight, heat, air currents, ozone (caused by operation of electrical equipment), oil, moisture, water, dirt and weight.

The following procedure is recommended for storage of tires, whether it be for prolonged periods or for periods possibly as little as two weeks under extreme conditions.

1. When it is necessary to store tires while mounted on vehicles, block the vehicle up as shown at (2) so that the weight does not rest on the tire. Reduce air pressure to 50 per cent of operating pressure.



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PROTECTING TIRES WHILE STORING MOTOR GRADER

1—Cover of canvas or similar material. 2—Blocks.

2. Where vehicle cannot be blocked up, check air pressure in the tires frequently and maintain at proper pressure.
3. Each tire in either of the above cases should be protected by a cover of canvas or similar material as shown at (1) or painted with a synthetic rubber paint. This protection keeps water from working its way into small fractures where it can freeze and cause extensive damage.
4. When stored inside, tires should be kept in a cool, dark, dry area and free from air currents.
5. Never store tires near electrical devices such as electric motors or switches. They are an active source of ozone which deteriorate rubber.
6. Do not store tires in the same or adjoining rooms with gasoline and lubricants. The solids, fluids, or vapors from them are readily absorbed by the rubber causing it to deteriorate.

ALTITUDE OPERATION

The maximum turbocharger speed is determined by the fuel rack setting, the high idle speed, the turbine nozzle and the altitude at which the engine is operated. The rack and high idle speed settings have been established to permit the engine to be operated at the altitude marked on the warning plate on the front of the instrument panel housing. The turbine nozzle is the same for all altitudes, but the engine fuel rack setting and high idle speed vary with altitude. If the fuel rack setting is greater than specified for the altitude at which the engine is being operated or the high idle speed is too high, **serious damage or injury due to**

The maximum altitude at which the engine may be operated at the present setting is marked on the warning plate on the front of the instrument panel housing. The governor housing and turbocharger are sealed for your protection. **Changes to the turbocharger, fuel rack setting, or high idle speed should be made only by direct support personnel.**

The engine can be operated at a lower altitude than marked on the warning plate without danger of turbocharger overspeeding, but with slightly less than maximum performance, however the fuel rack setting must be changed when operated at a lower altitude to get full power. **When operated at a higher altitude, the fuel rack setting must be changed by DS personnel.** After making any changes, new altitude limit will be marked on the warning plate and the governor housing will be resealed for your protection. This will assure you that correct settings have been made.

IMPORTANT: Consult with DS personnel before operating at a higher altitude than marked on the warning plate.

Maintenance Instructions

The foregoing paragraphs have been devoted to instructions which are necessary for day-to-day operation of the motor grader. The following topics give detailed instructions regarding the care and adjustment of the various parts.

AIR CLEANERS

Regular service intervals, along with close visual inspection of the precleaner and dry type air cleaner, are necessary for proper cleaning of the engine inlet air. The service interval will vary with the weather and working conditions. During dry, dusty months where dust conditions are severe, it will be necessary to service the precleaner and air cleaner frequently. In damp weather and other conditions of little or no dust, the service interval can be extended.

To extend the service life of the element, the exhaust and air cleaner inlet pipes should be arranged so that exhaust and/or oil fumes do not enter the engine air cleaner.

Diesel Engine Dry Type Air Cleaner

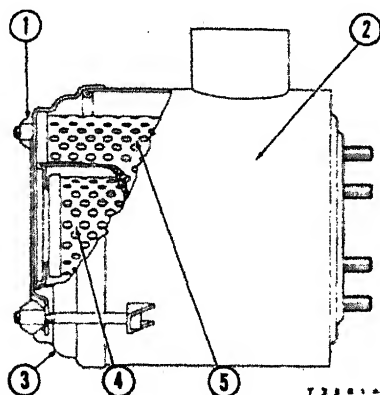
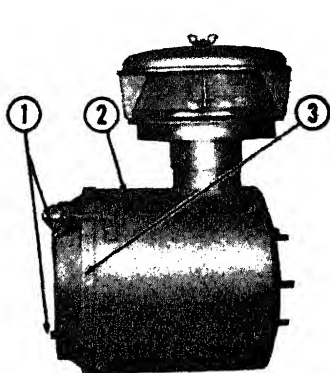
The dry type air cleaner is to be used without oil.

An extra filter element should be kept on hand for replacement use in the air cleaner while the element that was removed is being cleaned.

Excessive engine exhaust smoke and/or loss of power may indicate the need for servicing the air cleaner. **Never service the air cleaner while the engine is running.**

Primary Filter Element: Every 125 to 250 service hours, in average operating conditions, remove the filter element for inspection and cleaning. This period may be extended in clean atmosphere and can only be determined by experience.

1. Loosen the wing nuts (1) and remove the end cover (3) of the filter case (2).
2. Remove the primary filter element (5).
3. Remove any dirt which has accumulated on the bottom of the case.



DRY TYPE AIR CLEANER

- 1-Wing nuts. 2-Filter case. 3-End cover. 4-Secondary filter element.
5-Primary filter element.

Secondary Filter Element: Every 1000 service hours, remove and service the safety element.

1. Remove the stud nuts that secure the secondary filter element (4) and filter case (2) to the diesel engine air inlet.
2. Remove the air cleaner assembly and cover the air inlet to the engine.
3. Remove the end of the filter case as instructed in the preceding topic.
4. Remove the primary and secondary filter elements.
5. Clean the elements as instructed in the following topic.

Cleaning Filter Elements:

The ends of a filter element can be damaged by bumping or tapping. Bent and/or dented ends cannot seal properly and may allow unfiltered air to enter the engine cylinders thus causing premature engine wear.

Direct air against the inside of the element, holding the nozzle at least one inch away, to loosen any imbedded dirt. Best results can be obtained by moving the air hose so that air is directed along the complete length of each pleat.

Blow off loose dirt by directing air against the outside of the element.

Repeat this procedure until the element is clean. Make certain that no dirt is inside the element.

- b. Using clean water, at a pressure not to exceed 40 PSI, proceed as follows:

Direct water against the inside of the element to loosen any imbedded dirt. Best results can be obtained by using a water hose without a nozzle and moving it so that water is directed along the complete length of each pleat.

Wash off loose dirt by directing water against the outside of the element.

Repeat this procedure until the element is clean. Make certain that no dirt is inside the element and that the element is thoroughly dry before installing it.

- c. Some oily and/or sooty deposits can be removed by washing the element in a solution of warm water and a good household non-sudsing detergent. Rinse with clean water as in "b" above.
2. Thoroughly clean all parts of the air cleaner. Visual inspection of the gaskets is important in keeping dust from by-passing the air cleaner filter elements. Air leakage can upset proper air cleaner action. If the condition of the gaskets is questionable, replace them. If the sealing ends of the filter elements or the element pleats are damaged, replace the elements.
3. Assemble the air cleaner. This air cleaner requires no oil.

If after cleaning, the engine exhaust smoking and/or loss of power has not been corrected, or the restriction has not been reduced, replace the elements.

Replace both filter elements at least once a year.

Starting Engine Dry Type Air Cleaner

Every 125 to 250 service hours clean the filter element. The element may have to be cleaned more often during dusty conditions or whenever hard starting and/or loss of speed and power is observed. To service the element proceed as follows:

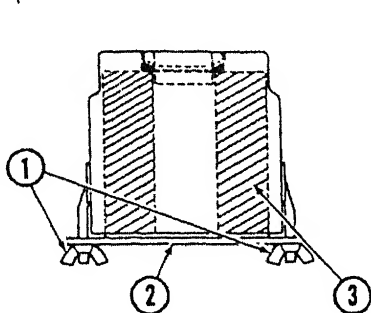
1. Unscrew the wing nut (1) which retains the assembly.
2. Remove the air cleaner cover plate (2); on earlier air cleaners, case (2) and the filter element (3).

the element to the outside. Do not let dust collect on the inside of the element.

While the filter is removed inspect and clean all parts of the cleaner before assembly.

If the element is damaged or if after cleaning, the engine is hard to start and/or loss of power has not been corrected, install a new element.

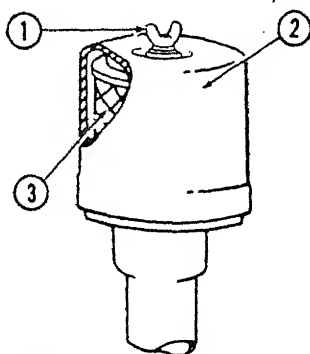
Replace the element at least once a year.



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AIR CLEANER ASSEMBLY
(Later type)

1-Wing nuts. 2-Cover plate.
3-Filter element.



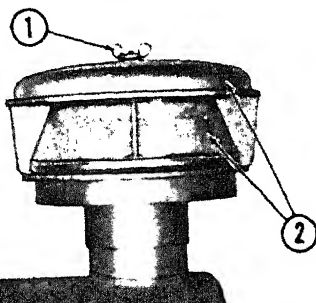
T 40189

STARTING ENGINE AIR CLEANER
(Earlier type)

1-Wing nut. 2-Case. 3-Filter element.

Precleaner

Remove and empty the body assembly when the dirt reaches the line in the body assembly by loosening the wing nut (1) that holds the cover and body assembly (2) in place. Inspect the fins in the precleaner regu-



PRECLEANER

1-Wing nut. 2-Cover and body
assembly.

larly, and when they are dirty, remove the entire precleaner, and wash it in water.

Air Inlet Pipe Extension: Where dust conditions are severe, dust and abrasives may be carried in a heavy cloud rising to the height of the air inlet. For these conditions an air inlet pipe extension is available from your Caterpillar dealer.

Washing the Crankcase: Whenever the diesel engine oil pan is removed for any reason it should be thoroughly cleaned before it is re-installed. The oil pump screen should also be cleaned while the oil pan is off the engine.

FUELS

See maintenance and operating supplies listing - -
Appendix B.

CARE OF THE FUEL SUPPLY

Keep The Fuel Clean: Too much emphasis cannot be placed on the importance of using only clean diesel fuel. It is important to buy clean fuel, and keep it clean. The best fuel can be rendered unsatisfactory by inadequate storage facilities or careless handling. The clearance between the fuel injection pump plunger and the barrel is very small, actually less than .0001 inch (0.00254 mm.), which makes it evident that the invisible particles of dirt which might pass through the filter can damage these finely finished parts.

Effort should be constantly expended to prevent contamination of the fuel. Important steps are to use clean containers and funnels and to reduce the number of times the fuel must be handled. When the fuel can be delivered by the distributor to storage tanks and then pumped from the storage tank to the diesel fuel tank, the handling is reduced to a minimum.

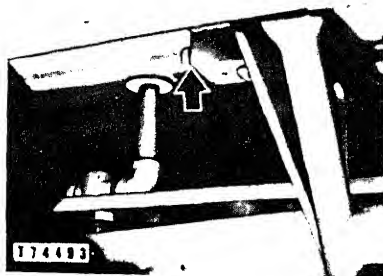
Since natural settling is an effective method of cleaning diesel fuel, the fuel should be allowed to stand at least 24 hours in the storage tank after it has been filled before fuel is transferred to the diesel fuel tank. Be sure to drain all water and sediment that has settled to the bottom of the tank before the tank is refilled. Occasionally, drain all of the fuel and clean the tank thoroughly.

CARE OF THE DIESEL FUEL TANK

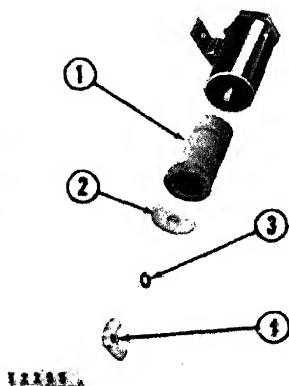
Fill the diesel fuel tank at the end of the day, because the incoming fuel will drive out the moisture-laden air and prevent condensation.

Diesel Fuel Tank: The fuel level in the diesel fuel tank may be checked with the plunger gauge in the filler opening.

Every 125 service hours, before starting the engine, open the diesel fuel tank drain, under the diesel fuel tank, and drain off any sediment or water which may have accumulated. The strainer in the diesel fuel tank filler opening should be removed and cleaned regularly. Remove the retainer ring and lift out the strainer.



**DIESEL FUEL TANK
DRAIN**
(One drain on each side)



**FUEL TANK BREATHER
FILTER**
1-Element. 2-Flat washer. 3-Lock
washer. 4-Wing nut.

Diesel Fuel Tank Breather Filter: Occasionally, or when the lack of fuel flow to the transfer pump interferes with proper fuel injection, clean the fuel tank breather filter which is located on the back of the operator's seat. Remove the wing nut (4) lock washer (3), flat washer (2) and ele-

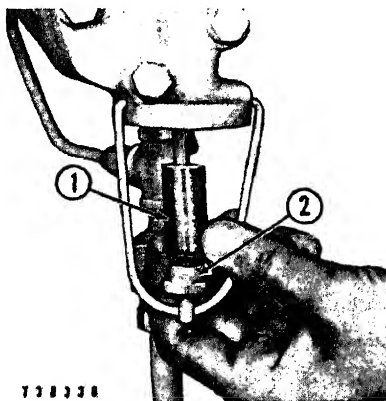
FUEL FILTERING SYSTEM

As either the edge-type filter element in the primary fuel filter or the resin impregnated cellulose material type filter element in the final fuel filter gradually becomes clogged with foreign material, the position of the fuel gauge indicator will work back from the original position in the NORMAL (green) range, to the CAUTION (white) range, and later into the OUT (red) range. When the indicator shows in the OUT (red) range, the primary filter element should be removed and washed. If the indicator still shows in the OUT (red) range, the final fuel filter element should be replaced.

Primary Fuel Filter

A primary fuel filter, mounted on the fuel transfer pump housing just below the final fuel filter, is provided in the fuel system for the purpose of straining out foreign material from the fuel before it enters the fuel transfer pump. Every 50 service hours remove and clean the edge-type

PRIMARY FUEL FILTER
1-Edge-type filter element.
2-Nut.



filter element contained within the sediment bowl. Do this by first closing the diesel fuel tank valve, located under the diesel fuel tank, and removing the sediment bowl by unscrewing the nut (2) that clamps it to the body. Unscrew the edge-type filter element (1) and shake it in kerosene or some non-inflammable cleaning fluid. When the bowl is replaced see that the gasket is clean, in good condition, and correctly positioned. See the topic, PRIMING THE FUEL SYSTEM.

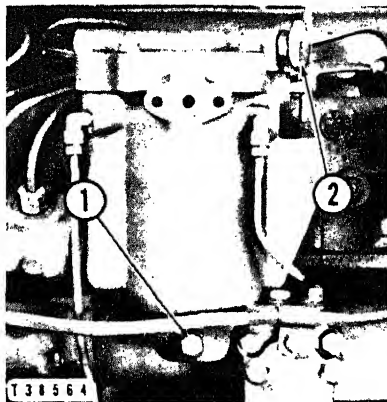
Final Fuel Filter

Draining Fuel Filter Housing: Every 50 service hours, or even as often as daily during extremely low temperatures, drain the filter housing of



**DIESEL FUEL TANK
VALVE**

(One valve on each side)



**DRAIN FUEL FILTER
HOUSING**

1-Drain plug. 2-Vent.

open the filter housing vent (2). Replace the drain plug, and prime the system. See the topic, PRIMING THE FUEL SYSTEM.

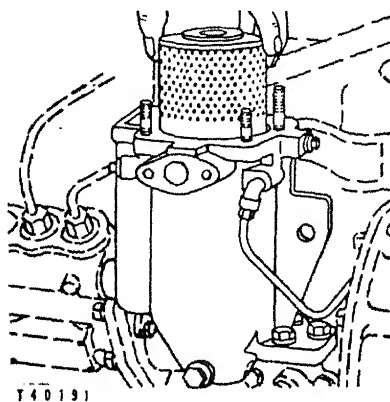
Final Fuel Filter Element: The final fuel filter element is of the resin impregnated cellulose material type. When the pleated element has collected enough contamination to interfere with engine performance, it must be replaced with a new one. This element will continue to collect particles until fuel will no longer flow through it at a rate to maintain maximum engine performance. It will not discharge its burden into the clean fuel; this is prevented by the fine grade filter media around the perforated metal core.

The resin impregnated cellulose material type filter element collects and holds contaminants and cannot be washed or otherwise restored.

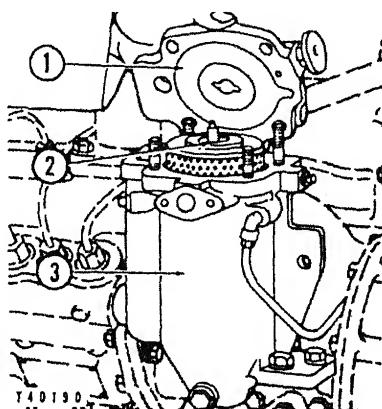
As the filter element gradually becomes clogged with foreign material, the position of the fuel gauge indicator will work back from the original position in the NORMAL (white) range, to the CAUTION (green) range, and later into the OUT (red) range. When the indicator shows in the OUT (red) range, a new filter element should be installed.

Removing Used Filter Element: To remove the used filter element proceed as follows:

1. Close the diesel fuel tank valve.
2. Remove the filter housing drain plug.
3. Open the filter housing vent.
4. Thoroughly clean the top of the cover and around the edges of the



REMOVING FILTER ELEMENT



INSTALLING FUEL FILTER ELEMENT

1-Filter cover. 2-Rod. 3-Filter element.

5. Remove the filter housing cover.
6. Lift the filter element out of the housing. The rod and rod spring may be lifted out of the housing to permit the inside of the housing to be thoroughly cleaned if so desired.

Installing Filter Element in Housing: To install the element in the housing proceed as follows:

1. If the rod and rod spring have been removed from the housing, replace the spring and then the rod (2) in the housing. Make certain the rod enters the drilled hole in the bottom of the housing and that the spring is piloted on the boss of the housing and rod.
2. Place the filter element (3) over the rod.
3. Place a new gasket on the filter housing.
4. Replace the filter cover (1).

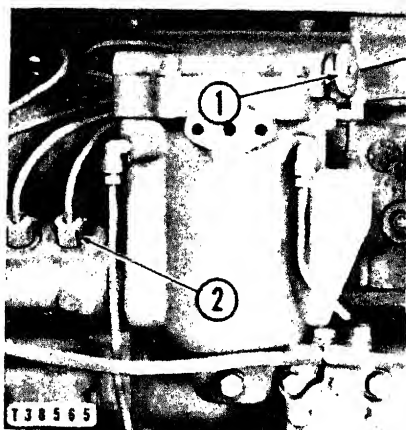
Keep a New Filter Element on Hand: An extra filter element should be kept on hand for replacement. Always keep the element wrapped and in its original carton to insure against dust and dirt accumulation which will shorten the life of the element if it gets on the outside or may cause damage to the fuel injection equipment if it gets on the inside.

PRIMING THE FUEL SYSTEM

Any time the fuel flow is broken and air is allowed to get into the fuel

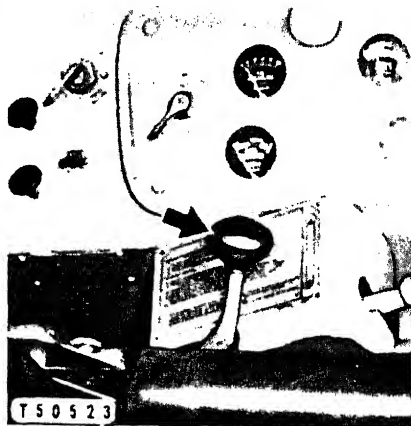
When Equipped With Gasoline Starting Engine: Priming the fuel system will allow the fuel transfer pump to force air and fuel through the fuel filter and the fuel injection pumps if the engine is level. Prime the system as follows:

1. Check to see that the diesel fuel tank valve is open.
2. Lift the gov. control past the low idle stop position to shut off the fuel injection pumps.
3. Move the compression release lever to the start position.
4. Start the starting engine, engage the starter pinion and clutch and allow the starting engine to crank the diesel engine at starting engine low idle speed.



FUEL FILTER VENTS

1-Vent valve. 2-Fuel injection line nut.



**COMPRESSION RELEASE LEVER
IN THE START POSITION**

5. Open the fuel filter vent valve (1) and loosen the fuel injection line nuts (2). When the flow of fuel from the vent and pumps is continuous and contains no air bubbles, close the vent valve and tighten the line nuts.
6. Open and close the vent valve and line nuts several times in succession to be sure all air is bled from the system.

FUEL INJECTION EQUIPMENT

When improper fuel injection is affecting the diesel engine operation, a systematic check should be made to determine the cause. The most likely cause is dirt or water in the fuel. Drain the sediment from the diesel fuel tank and drain the fuel filter housing. Check the fuel pressure gauge as mentioned in the topic, CARE OF THE FUEL FILTER. Replace the filter if necessary. Then prime the fuel system until clean fuel reaches the fuel injection pumps. If the fuel system is air bound, priming the system will overcome the difficulty.

When the engine is running irregularly and smoking, a fuel injection valve may not be spraying the fuel properly.

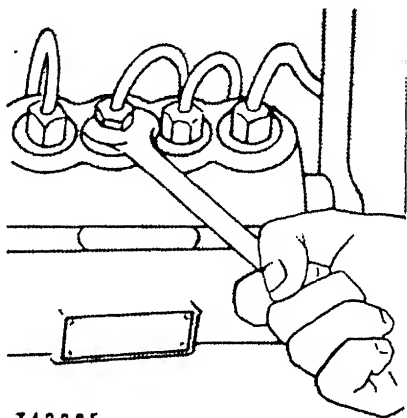
As the clearance between the plunger and the barrel of a fuel injection pump increases, due to wear, fuel leakage occurs. When the leakage increases to the point where insufficient fuel is injected into the cylinder, a loss of power is noticeable. With the loss of power, hard starting is also encountered.

Fuel Injection Valves

Testing Fuel Injection Valves: Whenever an engine performs in such a

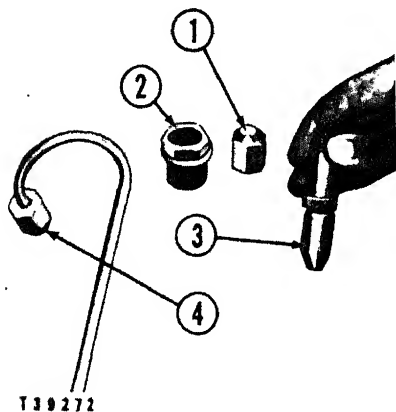
affected, this identifies the defective valve and a new one should be installed in that cylinder. These valves can be tested by direct support personnel.

**LOOSENING FUEL LINE NUT
TO TEST VALVE**



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Removing Fuel Injection Valves: Before removing a valve, clean the dirt from around the valve and connections.



**REMOVING FUEL INJECTION
VALVE**

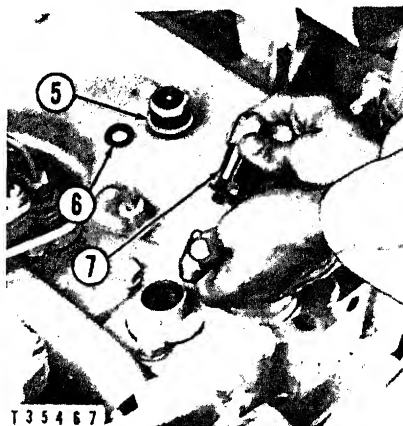
1-Cap. 2-Retainer nut. 3-Fuel injection
nozzle assembly. 4-Plug.



Installing Fuel Injection Valves: Before installation of a fuel injection valve, be sure the wrench is clean. Put the dust cover on the valve body as soon as possible to prevent dirt entering the fuel passage. Install the fuel injection valve in the following manner:

INSTALLING FUEL INJECTION VALVE

5-Large seal. 6-Small seal.
7-Injection valve body.



1. Screw the injection valve body (7) into the fuel injection nozzle assembly (3) only finger tight. The threads of the body and nozzle assembly are made to fit loosely. The clearance between the threads provides a passage for fuel to enter the nozzle assembly from the body.
2. Insert the nozzle assembly and valve body as a unit into the pre-combustion chamber opening. Turning the body in a clockwise direction and at the same time pressing down will assure alignment of the serrations.
3. Install a new large seal (5) on the retainer nut. A light coating of lubricant on the seal will permit it to seat properly.
4. Tighten the retainer nut good and tight to prevent leaks between the nozzle assembly and the nozzle assembly seats. A torque of 100 to 110 pounds feet is adequate to tighten the retainer nuts.
5. Place a new small seal (6) over the threads on the top of the valve body and on the retainer nut.
6. Connect the fuel injection line and tighten the nuts.

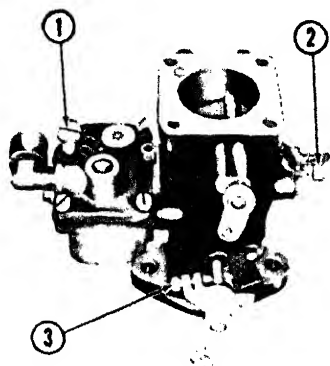
cates worn injection pumps. The tools and information required to service and check fuel injection pumps are available to direct support personnel.

STARTING ENGINE FUEL SYSTEM

Keeping the starting engine fuel tank filled will prevent condensation in the tank. Periodically drain any water which may have accumulated in the starting engine fuel tank sediment bowl. Check the carburetor for proper adjustment every 500 service hours.

Carburetor Adjustment: To obtain an approximate carburetor adjustment, turn the adjusting screws gently against their seats. Then back off the high speed mixture adjusting screw (1) one turn from the closed position and the low speed mixture adjusting screw (2) one half turn from the closed position.

A more accurate adjustment can be made with the engine running at full governed speed by turning the high speed mixture adjusting screw (1) out to make the mixture richer or in to make it leaner. Adjust this screw to a point that will give the greatest amount of power with a clean exhaust. Turn the low speed mixture adjusting screw (2) until the engine will idle regularly at slow speed without emitting black smoke from the exhaust. Turn this screw in to make the mixture richer or out to make it leaner. Turn the idling speed control screw (3) to the left (out) to decrease idling speed or to the right (in) to increase the speed.



CARBURETOR ADJUSTMENT

- 1-High speed mixture adjusting screw.
- 2-Low speed mixture adjusting screw.
- 3-Idling speed control screw.

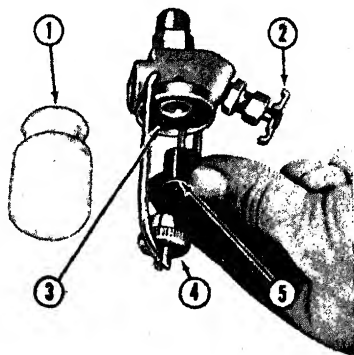


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Sediment Bowl Filter: The sediment bowl (1) collects water and sediment that may be in the fuel. To remove the collected water and sediment, close the valve (2) under the fuel tank and remove the bowl

STARTING ENGINE SEDIMENT BOWL FILTER

- 1-Sediment bowl. 2-Valve. 3-Gasket.
4-Nut. 5-Edge-type filter element.



T17841

COOLING SYSTEM

Coolants: Water used in the cooling system should be soft, or as free as possible from scale forming minerals. It is advisable to treat the available water with Rust Inhibitor. The use of this rust inhibitor in the cooling system will prevent the formation of rust. It will also retard, and in some cases completely eliminate mineral deposits within the engine. Most anti-freeze solutions contain rust inhibitors, therefore, it is not necessary to use rust inhibitors with those anti-freeze solutions which do contain inhibitors.

When the temperature is below freezing sufficient anti-freeze should be used in the cooling system to prevent freezing. Various anti-freeze mixtures such as ethylene glycol,

denatured ethyl alcohol, methanol (synthetic wood or methyl alcohol) and glycerine are all suitable for use. Alcohol can be used successfully but, because it readily evaporates at the normal operating temperature of the diesel engine, the solution should be tested frequently — even daily — and kept up to correct strength. This loss by evaporation is objectionable **but the temperature regulator should not be removed.** Doing so might make the solution run cooler and save the alcohol, but is not desirable for good performance. It is essential, therefore, that the coolant be tested frequently to assure adequate protection.

Filling: Fill the diesel engine cooling system and starting engine cooling system, if so equipped, by pouring the coolant into the radiator.



COOLING SYSTEM DRAINS

1-Heat exchanger drain plug. 2-Starting engine block drain plug.

Cleaning The Radiator: Every 10 service hours, clean dirt and trash from in between the tubes of the radiator which may cause excessively high operating temperature. This dirt may be easily removed by removing the four bolts which hold the radiator screen in place. Then wash, brush or blow the dirt out with whichever method is available and most effective.

Cleaning The Cooling System: An occasional washing of the cooling system may be necessary to remove the dirt and sediment which accumulates. The frequency of washing will depend on the amount of foreign material present in the water used in the system.

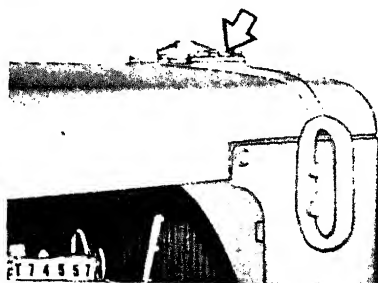
To wash the system, run the engine until the liquid in the cooling system is at operating temperature, and the loose foreign material is stirred up. Then stop the engine, and drain as quickly as possible before the sediment has time to settle. Close the drain and pour in kerosene equal to about one-tenth the capacity of the cooling system and fill the remainder with a solution of one-half pound (226.8 grams) of washing soda to each gallon (3.8 liters or .8 Imp. Gal.) of water. Run the engine for about one-half hour, and again drain and flush the system with clean water.

Commercially available cooling system cleaners may be used.

RADIATOR SEALED PRESSURE OVERFLOW UNIT

The sealed pressure overflow unit should be cleaned every 1000 service hours to remove lime deposits and other accumulations which might hold the valve in the "open" position. Such deposits are not so noticeable where inhibitors are used in the cooling system, but, even so, regular cleaning of the unit should be encouraged.

SEALED PRESSURE OVERFLOW UNIT



To clean the unit, disassemble by removing the screws which hold the cover in position. Lift off the cover, then remove the seal assembly and brush the parts thoroughly until all of the foreign matter has been removed. **Caution: Do not wash the unit in any kind of cleaning solution because so doing may damage the seal.**

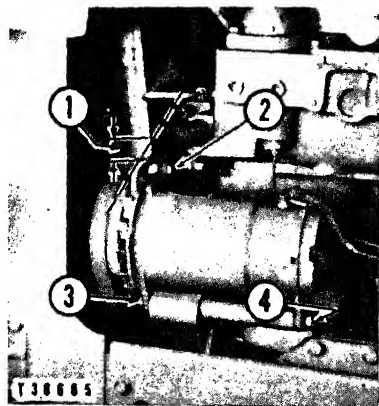
FAN BELT ADJUSTMENT

The fan belt should be checked every 250 service hours for proper adjustment.

If the fan belt is operated too loose it will slap against the pulleys, causing unnecessary wear to the belt and possibly slipping to the extent that the engine will overheat. If the belt is too tight, unnecessary stresses are placed upon the fan bearings and belt which might shorten the life

FAN BELT ADJUSTMENT

1—There should be $\frac{9}{16}$ to $\frac{13}{16}$ (1.4 to 2. cm.) slack at this point. 2—Retaining bolt. 3—Bolt. 4—Bolt.



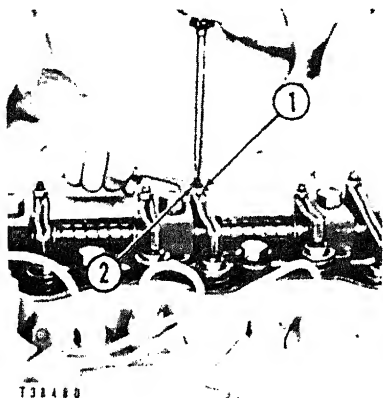
Adjusting Belt: To adjust the fan belt tension, loosen the retaining bolt (2) and bolts (3) and (4). Then move the generator against the belt to obtain the correct belt tension adjustment. The adjustment is correct when the belt can easily be pushed inward a distance of $\frac{9}{16}$ to $\frac{13}{16}$ inch (1.4 to 2.0 cm.) as shown at (1) with approximately 25 pounds pressure exerted midway between the pulleys. Check the adjustment after tightening the generator bolts.

DIESEL ENGINE VALVE CLEARANCE ADJUSTMENT

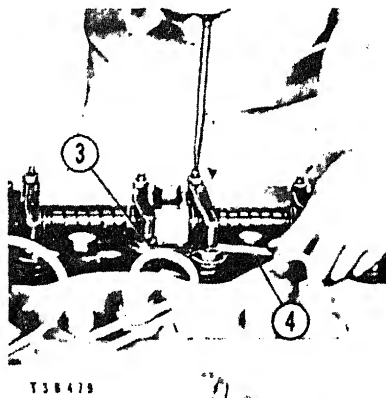
The initial valve clearance adjustment should be made after the first 100 to 125 service hours of operation. Thereafter, the clearances should be checked and adjusted if necessary after every 500 service hour interval.

The valve clearance adjustment should be made while the engine is hot, either while the engine is running or before it has been stopped twenty minutes after having run long enough to thoroughly warm up. When making the adjustment with engine stopped, turn the engine until the valve being checked is closed and the pushrod is at its lowest point. If the adjustment is made with the engine stopped and is not completed during the twenty minute interval, start the engine and allow it to warm up. The valve clearance adjustment must be made or the clearances checked, with the compression release lever in the run position.

To Adjust: Loosen the valve adjusting screw locknut (1), turn the adjusting screw (2) to allow a thickness gauge (4) to pass between the top of the valve stem (3) and the end of the valve rocker at the correct clearance. Set this clearance at .015 inch (.381 mm.) for inlet and .025 inch

**LOOSENING LOCKNUT**

1-Locknut, 2-Adjusting screw, 3-Valve stem, 4-Thickness gauge.

**ADJUSTING VALVE CLEARANCE**

The compression release clearance is not adjustable but it should be checked when the valve clearances are checked. The normal clearance between the inlet valve rocker and flat of the compression release shaft is about .060 inch (approximately .15 cm.). If the clearance is not approximately .060 inch, contact direct support personnel.

STARTING ENGINE VALVE CLEARANCE ADJUSTMENT

The initial valve clearance adjustment should be made after the first 100 to 125 service hours of operation. Thereafter the clearance should be checked and adjusted, if necessary, after every 500 service hours.

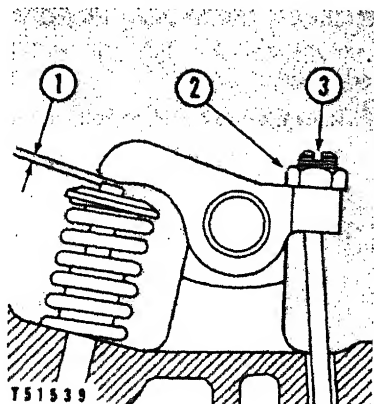
The valve clearance adjustment should be made while the engine is cold.

For valve adjustment proceed as follows:

1. Disconnect all linkage from the carburetor and remove the carburetor and the air cleaner as an assembly.
2. Remove the valve cover.
3. Turn the engine with the recoil starter until the valve closes and the push rod is at its lowest point.
4. Loosen the locknut (2) and with an off-set screwdriver turn the adjusting screw (3) to allow a thickness gauge of the correct thickness to pass between the top of the valve stem and the valve rocker arm at (1).
5. Adjust until there is .010 inch (0.25 mm.) clearance between the top

ADJUSTING VALVE CLEARANCE

- 1-Valve clearance for inlet and exhaust valves is .010 inch (.25 mm.). 2-Lock-nut. 3-Adjusting screw.



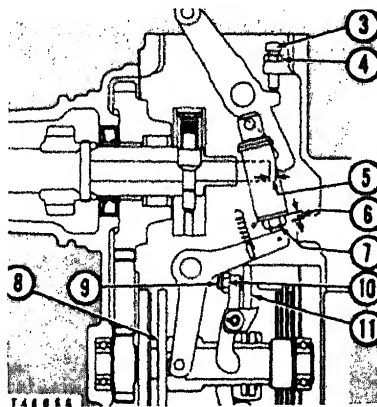
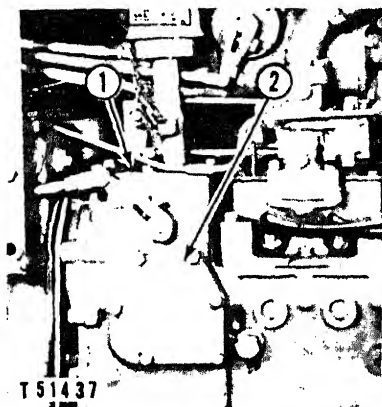
6. Tighten the locknut and check the adjustment.
7. Install the valve cover, carburetor and air cleaner.

SPARK PLUG ADJUSTMENT

The spark plugs should be examined every 1000 service hours. The gap may be kept at approximately .030 inch (.76 mm.). Measure this gap with a thickness gauge. To adjust the gap, bend the outer electrode.

STARTING ENGINE CLUTCH AND CLUTCH BRAKE

If the starting engine clutch slips, the starting engine clutch should be adjusted and the clutch brake adjustment checked.



STARTING ENGINE CLUTCH AND BRAKE

ceed as follows:

1. Turn the magneto switch OFF.
2. Remove the side cover (2) and the top cover (1), taking care not to damage the gaskets.

CAUTION

Attach a cord or wire to **all tools** to aid in their removal should they be accidentally dropped into the compartment.

3. Engage the starter pinion and re-engage starting engine clutch.
4. Pull the recoil starter mechanism as required to move the flywheel and clutch to positions where the locknuts (10) on the adjusting screws (9) in each of the three clutch arms may be loosened through the access opening in the side of the housing.
5. Move the clutch brake pressure plate (8) as far to the right as possible. A 3/16 inch hexagonal wrench (allen wrench) is used to adjust each of the three adjusting screws until a clearance of .030 to .040 inch (.76 to .92 cm.), measured with a thickness gauge, is obtained between the spherical end of the adjusting screws (9) and the plate (11). Tighten the locknuts and recheck the clearance.

Adjusting the Starting Engine Clutch Brake: If the starting engine pinion gear clashes with the diesel engine ring gear, when the clutch and starter pinion lever is moved to clutch brake and pinion engaged position, the clutch brake should be adjusted.

The starting engine clutch must be engaged when making clutch brake adjustments. To adjust the clutch brake proceed as follows:

1. Proceed as in steps 1 through 2 of the previous topic, ADJUSTING THE STARTING ENGINE CLUTCH.
2. Through the opening at the top of the housing, loosen locknut (4) and turn screw (3) until the pinion engagement lever touches the shaft and there is no clearance at (5). To obtain the correct clearance at (5), turn screw (3) counterclockwise one and one-half turns. Tighten locknut (4).
3. Pull the recoil starter mechanism as required to move the flywheel and clutch to a position where a thickness gauge or wedge may be placed between the spherical head of the adjusting screw (9) and the plate (11) to remove only the "free play" of the clutch arms.
4. Move the starter pinion and clutch control lever from the clutch engaged position (as far down as possible) upward until spring resistance is encountered and measure the vertical travel (6) of the linkage assembly. The correct free travel or play of this linkage is .030 inch (.076 cm.).

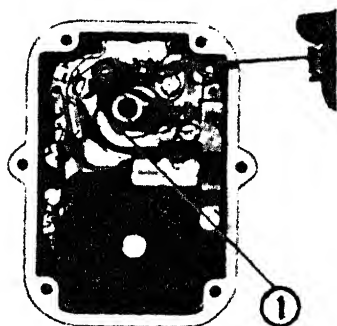
5. If the measurement of linkage assembly travel is not approximately $1/32$ inch, turn the locknut (7) clockwise to decrease and counter-clockwise to increase the amount of linkage assembly travel.
6. Remove the thickness gauge or wedge from the clutch arm and replace the top and side covers.

STARTING ENGINE MAGNETO

Do Not Lubricate The Magneto At Any Point: The bearings are packed with a ball and roller bearing lubricant when assembled, and this should be replaced only when the magneto is taken to direct support for checking or reconditioning.

Checking Contact Point Opening: Every 1000 service hours check the contact point opening.

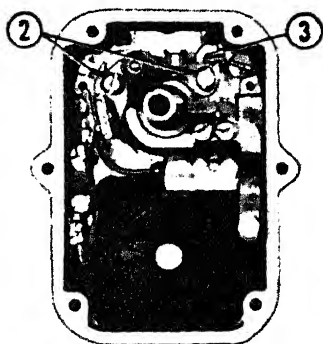
To check, first remove the distributor cap. Care should be taken in removing the cap not to damage the gasket. Clean any carbon dust from the inside of the plate and any carbon track from the rotor using a soft cloth, dampened with a non-inflammable cleaning fluid. Remove the distributor rotor, then turn the engine until the contact bumper block (1) is on one of the highest elevations of the cam. Check the clearance with a thickness gauge between the contact points as illustrated. This clearance should be .015 inch (.38 mm.).



T58858

CHECKING CONTACT POINT OPENING

1-Contact point bumper block on one of the highest elevations of the cam.



T58859

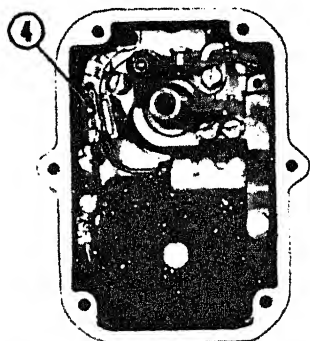
ADJUSTING CONTACT POINT OPENING

2-Bracket fastening screws.
3-Slot.

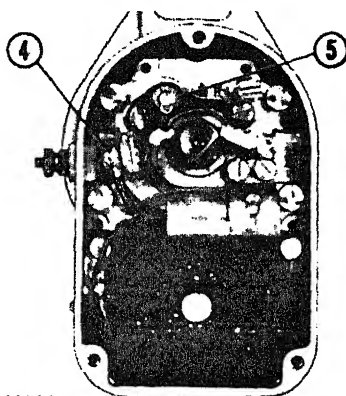
Adjusting Contact Point Openings: Loosen the screws (2) which hold the adjustable contact point bracket and move the bracket by inserting a screwdriver in the slot (3) and turn either clockwise or counterclock-

To Remove the Contact Points: To remove the contact points on later magnetos remove the spring clamp screw (4), and bracket fastening screws (2) used in adjusting the contact point opening.

To remove the contact points on earlier magnetos, remove spring clamp screw (5), lockwasher (4) and the two screws (2) used in adjusting the contact point opening.



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T57736

REMOVING CONTACT POINTS

(Later Magneto)

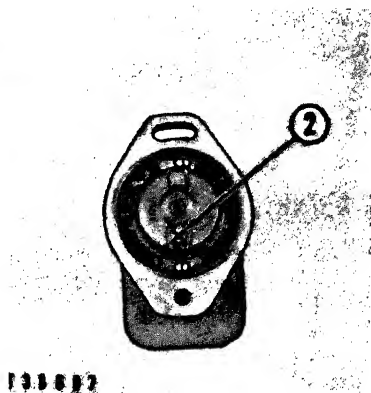
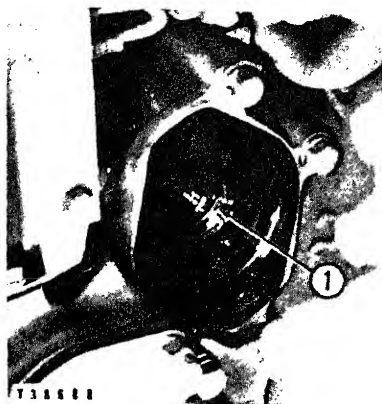
4-Spring clamp screw.

(Earlier Magneto)

4-Lock and washer. 5-Spring clamp screw.

Testing: A magneto can be tested when coupled to the engine. Remove the cable from a spark plug (rotate the terminal to facilitate removal), insert a 1/4 inch (6 mm.) bolt or similar metal object into the terminal to contact the wire, and hold the terminal so the end of the bolt is 1/8 inch (3.17 mm.) away from the metal base of the spark plug. Turn the run-start switch to the START position to crank the engine, or to the RUN position while hand-cranking the engine. If no spark occurs between the bolt and the spark plug base, disconnect the magneto switch wire from the terminal on the magneto and test again. If a spark now occurs with the switch wire removed, the wire from the magneto to the switch has become grounded or the switch requires replacement. If, with the switch wire off, the magneto still does not fire, remove the magneto as instructed in the next paragraph and take it to **DS personnel** for testing.

To Remove the Magneto for Testing: Disconnect the cables from the magneto. One of the cables should be tagged or marked in some convenient manner which will designate the proper position of these cables. Remove the two bolts that hold the magneto to the timing gear cover and



TIMING MARKS

1-Mark "X" on magneto drive. 2-Mark "X" on the impulse coupling tang.

To Time the Magneto to the Engine: To time the magneto to the engine, proceed as follows:

1. Locate the "X" mark (1) on the starting engine magneto drive.
2. Turn the magneto impulse coupling until the "X" mark (2) on the tang is in such a position as to line up with the mark on the magneto drive.
3. Install the magneto with the "X" marks together and tighten the bolts.

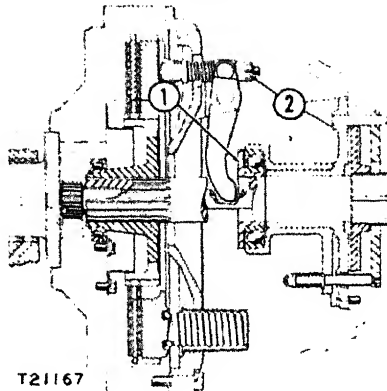
To Reinstall Magneto Wires: To reconnect the magneto wires proceed as follows:

1. Place the spark plug wire from number 1 cylinder (the cylinder farthest away from the flywheel) into the top wire receptacle of the magneto cap.
2. Install the other spark plug wire.
3. Reconnect ground wire.

FLYWHEEL CLUTCH

The flywheel clutch is a double plate oil type clutch. The plates and internal parts of the clutch are lubricated from a section of the oil pump in the diesel engine crankcase. The other section of the crankcase lubricating oil pump is a scavenge oil pump that returns the oil from the flywheel housing to the diesel engine crankcase.

As the clutch linings wear the free movement of the clutch pedal decreases. Maintain a free movement of 1 1/2 to 2 inches (4.7 to 5.0 cm.)



T21167

FLYWHEEL CLUTCH ADJUSTMENT

- 1-Release bearing thrust ring.
- 2-Adjusting nut.

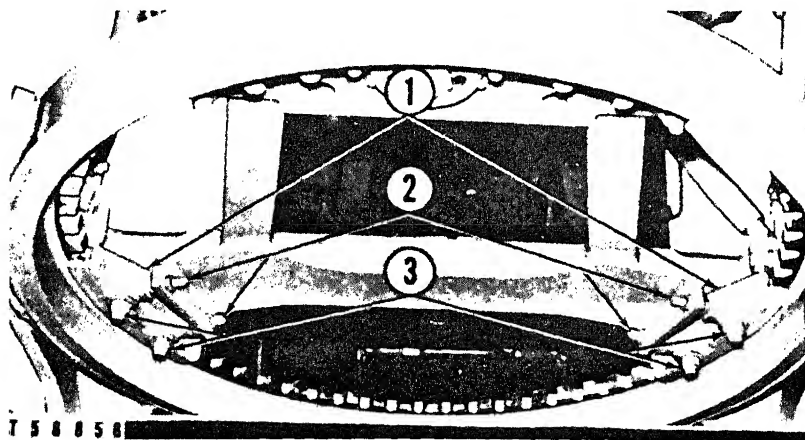


Remove the inspection cover on the left side of the clutch compartment and adjust the clutch as follows:

1. Remove the cotter pins from adjusting nuts and screws.
2. Turn each adjusting nut (2) clockwise until the release lever touches the release bearing thrust ring (1).
3. Turn the adjusting nut two thirds of a turn counterclockwise. This will give the necessary $\frac{1}{8}$ inch clearance between the release lever and release bearing thrust ring.

CIRCLE ADJUSTMENT

Side Play Adjustment: There are adjustable shoes in the two rear circle guides to eliminate the side play in the circle. These shoes may



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CIRCLE ADJUSTMENT

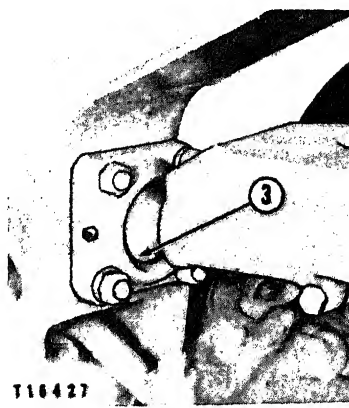
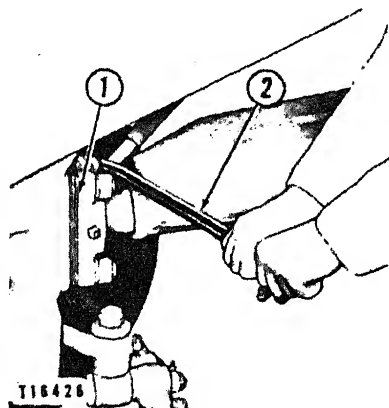
- 1-Shims for vertical play adjustment. 2-Set screws. 3-Bolts holding shoes.

be expanded to work against the inner edge of the circle by means of screws (2) located on the inner side of the circle guides. To adjust, loosen the bolts (3) holding the guide shoes to the frame, and loosen the screw locknuts. Turn the set screws down tight and back off until the circle turns freely. Tighten the bolts and the locknuts on the set screws. Both guides must be adjusted an equal amount, otherwise the circle will bind at the front.

Vertical Play Adjustment: Shims (1), between the circle drawbar and the front and rear adjustable guide shoes, can be removed or added to control the vertical play of the circle.

CIRCLE DRAWBAR ADJUSTMENT

The ball socket at the front of the circle drawbar has shims (1) which may be removed when excessive looseness is noted. To check the amount of looseness, raise the blade. Then insert a bar (2) between



CIRCLE DRAWBAR BALL SOCKET JOINT
1-Shims. 2-Bar. 3-Clearance at this point.

drawbar and the ball socket, as shown. Pry the drawbar back (away from the socket joint) as far as possible. Remove the bar. Observe the clearance at (3) between the ball and the socket cap. If this clearance exceeds 1/16 inch (1.6 mm.) remove one shim.

CENTER SHIFT CONTROL PINION ADJUSTMENT

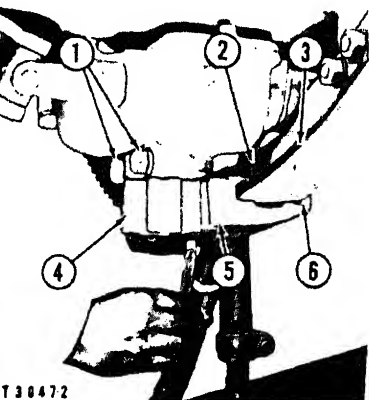
Motor graders are equipped with an adjustable center shift control pinion housing. This arrangement provides a means of controlling the center shift control pinion (4) and (5) and the pinion (4) from the

To Check The Adjustment: Remove the adjusting pin from the center shift link and proceed as follows:

1. Push the rack toward the pinion, with a bar, so that there is no clearance at (6) between the rack and rail (3).
2. Check the backlash with a thickness gauge by measuring the clearance between the fully meshed teeth of the rack and the pinion as shown. Check the backlash with the rack in three positions; right, left and center. If the backlash in any one position is more than .030 inch (.762 mm.) an adjustment should be made.

To Adjust: Adjust the backlash in the following manner:

1. Repeat Step 1 above.
2. Remove the nuts from bolts (1), take out the bolts and loosen the four nuts which hold the pinion housing to the frame.
3. Remove shims (2) to obtain a normal backlash adjustment of .010 inch (.250 mm.). For a guide in making the adjustment remember that the backlash will decrease by approximately half the shim thickness removed. Shims of .060 and .010 inch (1.525 and .250 mm.) are supplied for this adjustment.
4. Install the two nuts and bolts (1) and tighten them.



CENTER SHIFT CONTROL PINION ADJUSTMENT

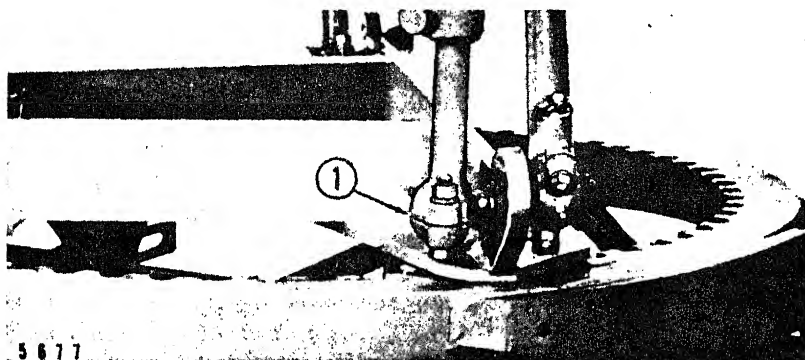
- Bolts. 2-Shims. 3-Rail. 4-Pinion. 5-Rack.
- No clearance between rack and rail at this point.

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5. Again check the backlash. The backlash should not be less than .010 inch (.250 mm.). Tighten the four nuts that hold the housing to the frame.
6. Replace the adjusting pin in the center shift link.

BALL AND SOCKET JOINT ADJUSTMENT

The ball sockets on the lift and center shift links have shims (1) which may be removed to compensate for wear. Test the amount of play in the sockets by lowering the blade to the ground. Observe the joints for slack



BALL AND SOCKET JOINT ADJUSTMENT

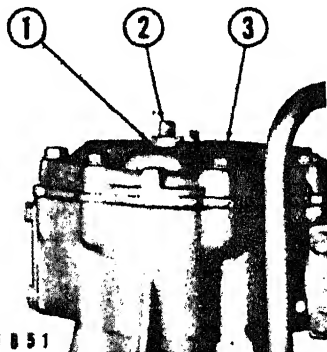
1—Shims.

STEERING GEAR ADJUSTMENT

Adjustment: When the free movement, or backlash, in the wheel becomes excessive, adjust the steering gear.

To adjust, first center the steering gear by turning the steerir from the extreme right to the extreme left position, counting the of turns. Then rotate the steering wheel back exactly halfway.

Loosen the locknut (1) and turn the adjusting screw (2) clock the cover (3) until a very slight drag is felt when turning the through mid-position.



ADJUSTING STEERING GEAR

1—Locknut. 2—Adjusting screws. 3—Cover



After making this adjustment and locking the locknut (1), turn the steering wheel through full travel (extreme left turn to extreme right turn).

BLADE SURFACE AND END BITS

When the motor grader must stand for more than two or three days, or under any condition causing rapid rusting, protect the blade surface with a coat of heavy grease while it is clean and polished. Rust on the blade surface prevents the dirt from moving freely along the blade, especially in sticky soil.

The blade may be cleaned of rust by washing it with a solution of one part hydrochloric (commercial muriatic) acid to three parts of water. When rust is dissolved, wash the blade with clear water to remove all trace of the acid. Lye may be used in place of hydrochloric acid if the blade is not too badly rusted.

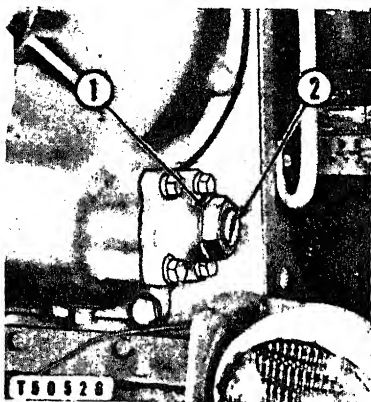
BLADE LIFT CONTROL EXTERNAL BRAKE

The blade lift shafts are provided with self-energizing shoe brakes. A preload spring holds the brake shoes in the engaged position at all times.

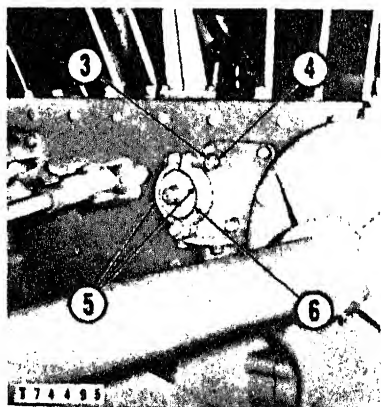
Adjustment

Adjust brake preload spring tension to prevent blade drop when operating the blade lift control as follows:

1. Loosen locknut (1).
2. Tighten adjusting screw (2) until it bottoms.
3. Tighten locknut (1). It may be necessary to hold the adjusting screw to keep it from turning when tightening the locknut.
4. Tighten nut (3) until lining of the brakes shoes (5) make contact with brake block (6). For new shoe adjustment, $\frac{1}{8}$ inch of threads on the bolt (4) will be showing behind the nut (3).



BLADE LIFT WORM GEAR
ADJUSTMENT



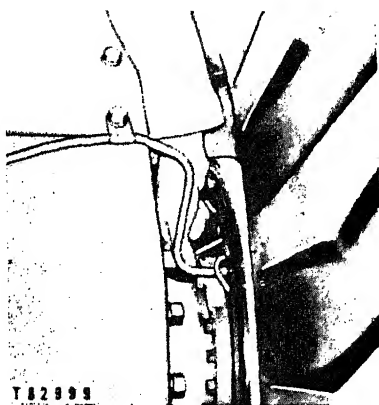
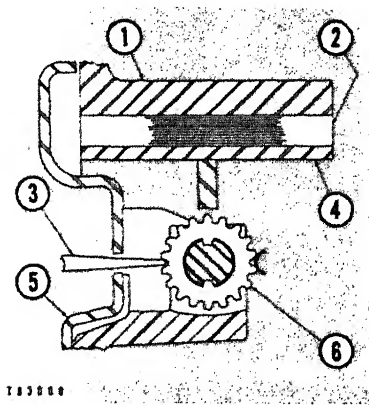
EXTERNAL BRAKE
3-Nut. 4-Bolt. 5-Brake shoes.

FOOT BRAKE ADJUSTMENT

Adjust the brakes if excessive brake pedal movement is required to apply the brakes.

Adjustment:

1. Remove rubber dust protector from brake front shoe adjustment hole in brake backing plate (5).
2. Insert a brake adjusting tool (3) through hole and turn star wheel (6) by pushing down on tool (3). Move brake front shoe (4) out until brake lining (2) is against brake drum (1).



ADJUSTING BRAKES

1-Brake drum. 2-Brake lining. 3-Brake adjusting tool. 4-Brake shoe.
5-Brake backing plate. 6-Star wheel.

3. Turn star wheel (6) three notches in the opposite direction by pulling up on brake adjusting tool (three notches for old brake shoe linings and five notches for new brake shoe linings).
4. Install rubber dust protector.
5. Remove rubber dust protector from rear brake adjustment hole in brake backing plate and repeat Steps 2 through 4 except pull up on tool to move brake rear shoe out until lining is against drum and push down on tool to move brake lining away from drum.
6. Repeat Steps 1 through 5 for remaining wheels.

Master Cylinder: The master cylinder is under the floor boards and can be filled after removing the master cylinder filler cap.

MASTER CYLINDER FILLER CAP



Use only a heavy duty hydraulic brake fluid of the non-mineral oil type meeting the requirements of SAE 70R3 in the master cylinder. The master cylinder level should be checked every 125 service hours, or when brake pedal effective travel is limited by the floor boards. Remove the filler cap and add fluid to bring the level to $\frac{1}{2}$ inch (1.3 cm.) below filler opening.

WARNING

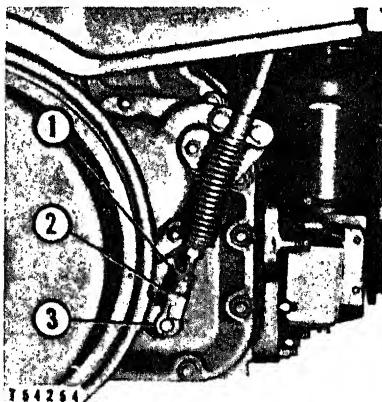
Some brake fluids are poisonous and should be handled in accordance with instructions on the container.

PARKING BRAKE ADJUSTMENT

The control lever should snap into the vertical position with a reasonably hard pull and remain in position until pushed forward to release the brake. When parking brake adjustment can no longer be made by turn-

PARKING BRAKE ADJUSTMENT

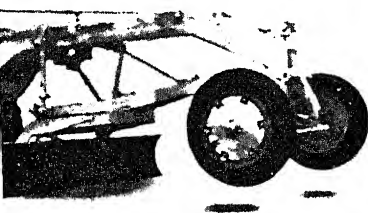
1-Locknut. 2-Clevis. 3-Pin.



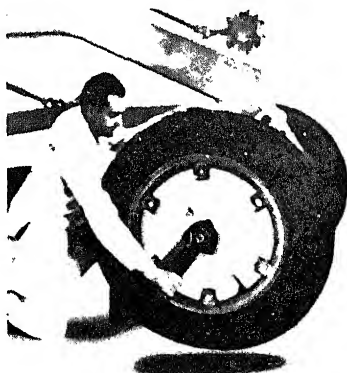
2. Loosen the locknut (1).
3. Remove the pin (3) from the clevis (2).
4. Screw the clevis onto the cable four complete turns to tighten.
5. Install the pin (3).
6. Tighten the locknut (1).
7. Turn the adjusting knob clockwise until brake adjustment is satisfactory. The brake lining must be free of the drum when the brake is released.

FRONT WHEEL BEARING ADJUSTMENT

The front wheel bearings should be checked occasionally for excessive clearance. Raise the wheel from the ground with a jack or by lowering the blade until the front wheels are lifted off the ground.



FRONT WHEELS RAISED BY
LOWERING BLADE



FRONT WHEEL BEARING
ADJUSTMENT

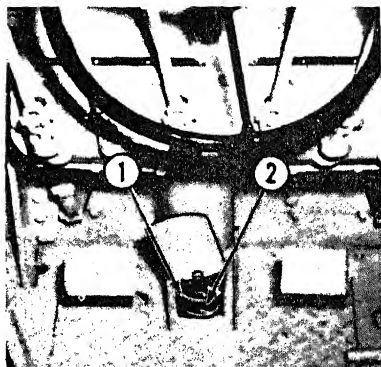
To Adjust: Remove the hub cap and lock pin from the bearing adjusting nut. Tighten the adjusting nut until the wheel locks when turned by hand, then back off the nut one-sixth turn and be sure the wheel turns freely. Replace the lock pin, the cotter pin and hub cap.

POWER CONTROL DRIVE SHAFT HOUSING

The power control shaft drive is equipped with a shear pin (2). This pin has sufficient strength to withstand normal expected operation but will shear when abnormal shock occurs; thus preventing damage to the controls.

POWER CONTROL SHAFT SHEAR PIN REPLACEMENT

1-Shaft flange. 2-Shear pin.

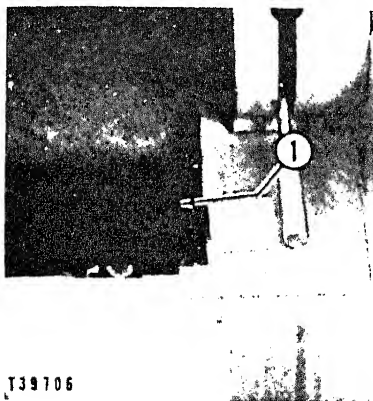


To install a new pin, raise the cover in the housing, rotate the shaft until the pinhole in the shaft flange (1) is accessible; then drop the pin in place.

SEAT ADJUSTMENT

The seat is adjustable forward and backward, as required for the operator's comfort. Adjust the seat in the following manner:

1. Raise the front side of the seat cushion (1).
2. Move seat cushion to the desired position and align the seat cushion pins with the holes in the seat support.



SEAT ADJUSTMENT
1-Seat cushion.



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3. Guide and lower seat cushion until pin alignment is assured.

TIRES

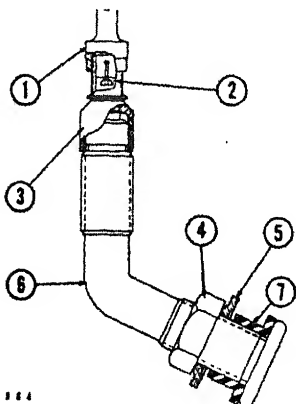
Proper handling and correct procedure in mounting, servicing and maintenance are essential to obtain all the advantages of tubeless tires. The following information has been prepared for this purpose.

1. Tires should be stored and transported in a vertical position. Horizontal storing may make initial inflation difficult.
2. Do not lift tire by the beads with hooks or forks unless forks are saddle type construction. Sharp hooks or forks may tear, cut or snag the tubeless tire beads and result in leaks at these points. The beads should be protected and tire handled with a chain or rope around the outside.
3. Any foreign material or moisture should be removed from inside the tire.

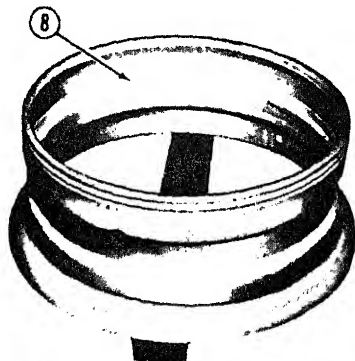
Rims: Tubeless tire rims perform an important function as part of the assembly air seal. Proper care therefore must be taken not to distort or mutilate the rim parts because they must mate properly to form part of the basic air chamber. For proper rim care see steps 1 through 7 as follows:

1. Never lift the rim using the valve hole.
2. Never drop, tumble, or roll rim parts.
3. If rim parts are to be stored outside in the weather, it is recommended they be given a protective coat of good commercial primer paint.
4. Like parts should be stacked neatly to prevent distortion.
5. Babbitt or lead hammers instead of steel hammers should be used in assembling rims.
6. O-ring seals for tubeless tires should be carefully stored in a cool, dry place and where they will not become damaged.
7. Valves should be stored in a cool, dry and clean place.

Tire Installation: This topic covers tire installation with the rim off the



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RIM AND VALVE ASSEMBLY

1-Valve cap. 2-Valve core. 3-Valve core housing. 4-Nut. 5-Washer.
6-Valve stem. 7-Rubber grommet. 8-Rim.

1. Clean dirt and corrosion from all rim parts and particularly in the groove and adjacent to the groove where the O-ring seal seats. If excessive corrosion is noticed, paint the rim base and rim parts with a good anti-corrosive paint.
2. Block the rim (8) up approximately 3 inches being sure the blocks do not extend beyond the rim flange.
3. Install the rubber grommet (7) on the valve stem (6). Insert the valve spud into the valve hole in the rim.
4. Install the washer (5) and nut (4) on the valve stem. Tighten the nut to a torque of 4 to 4½ pounds feet.



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5. Insert the valve core housing (3) into the valve stem and tighten.
6. Install the valve core (2) and valve cap (1).
7. Place the tire on the rim.
8. Place the flange ring (9) on the rim and tire making sure the flange ring does not bind on the rim base.
9. Stand on the flange ring to position it below the O-ring seal and lock ring grooves.
10. Snap the lock ring (10) into position.
11. Lubricate the O-ring seal (11) with a thin solution of high grade soap flakes and water or equivalent (do not use a soap with mineral or chemical base) and install it in the groove.
12. Stand the tire and rim assembly in a vertical position.

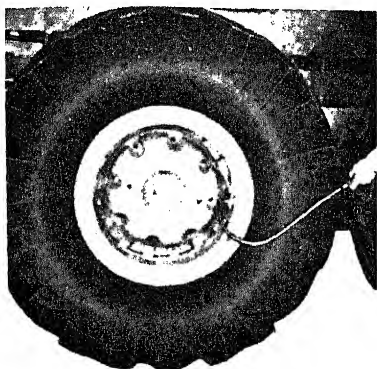
Inflation: After installation it is necessary to inflate the tires to 75 pounds pressure to assure proper seating of the tire beads. The tires should then be deflated to the recommended pressure. The following chart includes inflation recommendations for both standard and optional tire sizes.

No. 112 MOTOR GRADER TIRE INFLATION RECOMMENDATIONS ACCORDING TO TIRE SIZE AND EQUIPMENT MOUNTED ON GRADER

Tire Size		Ply Rating	**Maximum Pressure	A		Bulldozer Only	grader-scraper
FRONT TIRES							
	13.00 x 24	12	55	35		55	55
REAR TIRES							
	13.00 x 24	12	55	28 to 30		28 to 30	28 to 30

****For maintenance work on established highways.**

Pressures under column A apply to Grader With Scarifier, and Bulldozer.



**CORRECT POSITION FOR
INFLATING TIRE**



WARNING

For safe tire inflation self attaching air chucks are recommended. An air chuck that can be fastened to the tire valve will enable tire inflations to be accomplished with personnel standing behind the tread of the tire.

Operation During Highway Transportation: When driving the motor grader on highways a distance exceeding 50 miles, during a move from one job to another, the tire pressures used should be those listed in the preceding chart.

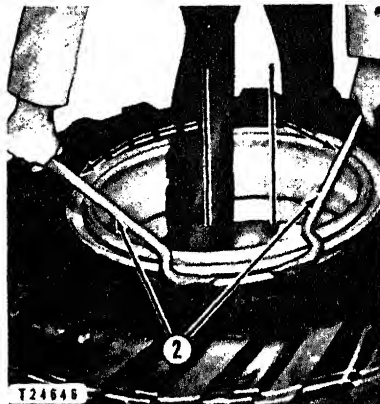
TIRE REMOVAL FROM RIMS

This topic covers tire removal with the rim off the wheel. However, the tire may be removed in a similar manner without removing the rim.

To Remove Tire and Rim from the Wheel: Raise the rear wheel with a jack. The front wheel may be lifted from the ground by lowering the blade and raising the front end of the machine. Remove the nuts and clamps which hold the tire rim to the wheel. Lift off the tire and rim.

Front and Rear Tires: Remove the tires from the rims as follows:

1. After complete deflation, place the tire and rim on a clean surface with the lock ring side up.
2. Starting opposite the valve, break the tire bead loose from the flange ring by driving the flat ends of two tire tools between the tire and flange (1) about 5 inches apart.
3. Pry with both tire tools (2) through an arc of approximately 70



BREAKING TIRE BEAD LOOSE FROM FLANGE

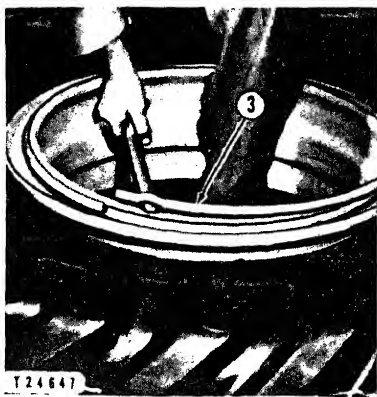
1-Flange. 2-Tire tools.

4. Repeat steps 2 and 3 around the tire and rim until the tire bead is completely loose from the flange ring.

NOTE

It may be necessary to drive the tools between the bead and flange at each new position of the tool the first time around the rim, but at no time is it necessary to hammer on either the rim or the tire.

5. After the tire bead is loosened, stand on the flange ring and tire sidewall to depress the flange ring down along the rim base; then, use the straight end of the tire tool, to pry loose the lock ring (3). Remove the O-ring seal (4). Then remove the flange ring.



REMOVING LOCK RING AND O-RING SEAL FROM RIM

3-Lock ring. 4-O-ring seal.

6. Turn the tire and rim over and break the tire bead loose by inserting both tools between tire bead and rim flange as instructed in step 2.
7. Repeat steps 2, 3 and 4 until the tire is completely loosened from the rim on the fixed flange side.
8. Stand the tire and rim in a vertical position. Remove the rim from the tire.

WASHING GEAR COMPARTMENTS

Washing The Transmission, Rear Axle And Tandem Drive Housings:

Remove the drain plugs from the transmission case, the transmission oil filter and the tandem drives. This should be done after a run when the oil is warm. Allow the oil to drain and replace the plugs. Fill the compartments to the proper levels with kerosene. Start the engine and run the motor grader back and forth for about five minutes. Use fourth speed when moving forward. Remove the drain plugs. After all the liquid has drained, replace the drain plugs and fill with fresh oil to the correct levels. When filling the transmission and rear axle housings, be sure the engine is running and the high speed shifter lever is engaged.

Washing the Power Control Housing: Remove the drain plug from the case after a day's run when the oil is warm. Allow the oil to drain and replace the plug. Fill the compartment to the proper level with kerosene and operate the controls for two minutes. Drain, replace the drain plug, and refill with fresh lubricant to the correct level.

Washing The Power Control Shaft Worm And Gear Housing: Remove the drain plug from the housing after a day's run when the oil is warm. Allow the old oil to drain and replace the plug. Fill the housing with kerosene to the correct level. Start and run the engine for two minutes. After the liquid has drained, replace the drain plug and refill with fresh oil to the correct level.

ELECTRICAL SYSTEM

The basic electrical system is composed of the following:

1. Battery.
2. Generator.
3. Generator regulator.
4. Wiring.

These components functioning together produce the electricity necessary for operating the electrical equipment on the machine and each is dependent upon the others for satisfactory operation. In the event of failure or improper operation it is essential to check the entire electrical system, as a defect in one component can cause damage to another.

The topics which follow describe the proper maintenance of the components to assure satisfactory operation of the electrical system.

Testing: The battery should be tested with a hydrometer and kept to a specific gravity of 1.250 or above. Always test a battery for degree of charge before adding water. The specific gravity between the cells should be within .025. A dangerously low point of charge is indicated by a hydrometer reading of 1.150 which will permit the battery to freeze. A specific gravity of 1.250 will permit the battery to withstand temperatures as low as -60° F. without freezing.

Water Addition: The electrolyte level should be maintained $\frac{3}{8}$ inch (9.5 mm.) above the separators or insulators by addition of distilled water or "approved water" (water free from impurities by analysis). Do not overfill or underfill the cells of the battery as either has a detrimental effect on battery life.

Charging: The charging rate is correct when the battery maintains a minimum specific gravity of 1.250 and does not require the addition of more than 1 ounce of water per cell per week or 50 service hours.

When there is evidence of either overcharging or undercharging, the cause should be found and corrected as soon as possible to protect the service life of the battery. See the topics, GENERATOR, GENERATOR REGULATOR and WIRING.

Cleanliness: Keep the top of the battery clean and dry to prevent current losses and keep the terminals clean and tight. To clean corrosion from the battery terminals, scrub them with a weak solution of bicarbonate of soda (baking soda) and water. Dry the battery thoroughly, then coat the terminals with lubricant to prevent corrosion. Keep the battery securely fastened in its compartment at all times.

Installation: When installing a battery in its compartment, fasten it securely and be sure to attach the cables to the correct battery terminals. Incorrect grounding of the battery will reverse the polarity of the electrical system and cause damage to the generator regulator. See the topic, GENERATOR REGULATOR.

Generator

Never operate a generator with an open circuit between it and the battery.

General Reconditioning: Every 2000 service hours, the generator should be removed and the commutator and brushes checked for glaze or darkening. At the same time the generator should be completely disassembled, washed and have all worn parts replaced.

Generator Removal: Remove all wires from the generator and tag them so that they may be correctly connected when the generator is reinstalled.

stalled. Remove the bolts or stud nuts that hold the generator in position and lift off the generator.

Generator Installation: Whenever a generator is installed, or reconnected to the generator regulator, it must be polarized **before** starting the engine. Follow the instructions carefully to prevent damage to the generator, generator regulator, or both, due to incorrect polarizing.

1. Place the generator in position and install the bolts or stud nuts.
2. Connect all wires to the generator, regulator and battery. See the topic, WIRING.
3. Polarize the generator.

Polarizing

Generator: Turn the disconnect switch ON, if so equipped, connect a jumper wire momentarily between the terminals of the generator regulator marked ARM and BAT.

Make sure all connections are tight. A poor connection in the charging circuit will cause the generator to build up excessive voltage which may result in burned field or armature windings. A poor connection in the generator field circuit will cause a low voltage.

Generator Regulator

The generator regulator is adjusted at the factory for average operating conditions. The regulator may have to be readjusted to provide the proper charging rate for the particular operating conditions of the machine. In case of failure of either the regulator or generator, both units should be taken to **DS personnel** where the output of the generator can be checked and the regulator adjusted accordingly.

Charging Rate: The normal function of the generator regulator is to adjust the generator charging rate by sensing the degree of charge in the battery. As the battery becomes fully charged, the charging rate should be reduced until the ammeter indicates a rate only perceptibly above zero.

When improper charging of the battery is encountered, the entire electrical system should be carefully checked. Loose or dirty connections, worn or broken wires, or a faulty generator can prevent a good regulator from functioning properly. See the topics, BATTERY, GENERATOR, and WIRING.

Polarity: Electrical systems may have either the positive or negative battery terminal grounded. When connecting the battery, be sure to ground the same battery terminal that was originally grounded. On new installations or where the battery grounding is questioned, check the generator regulator to determine the polarity of the system. The battery must be grounded as indicated on the regulator or damage will result. See the wiring diagrams to determine if the system has a positive or negative

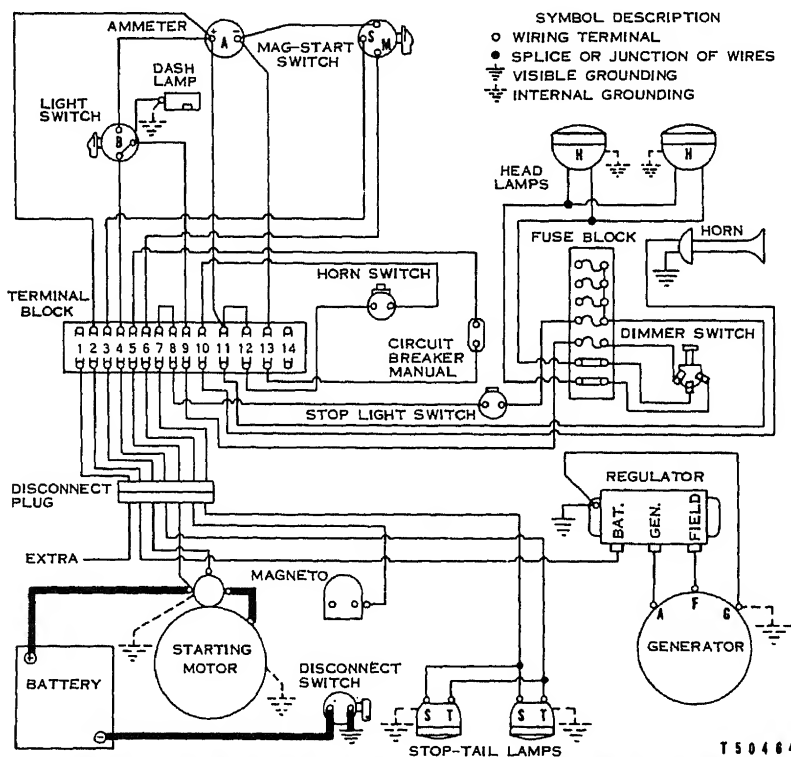
marks may appear in any of the following forms: "12 VOLTS - NEGATIVE GROUND," "12V - NEG.," or "12V N."

Wiring

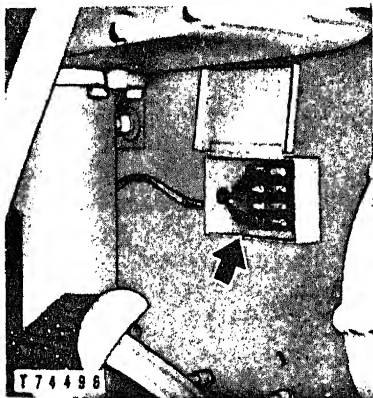
The wiring forms an important part of the electrical system and care should be used to protect it from damage. When the electrical system is being serviced, check the wiring for loose or dirty connections, worn insulation or broken wires. Inspect the battery terminals and cables. Poor connections or wiring can cause trouble or damage in other parts of the electrical system. See the topics, BATTERY, GENERATOR and GENERATOR REGULATOR.

Wiring Diagrams: The diagrams are furnished so that when it becomes necessary to disturb the electrical equipment for purpose of reconditioning or parts replacement, reassembling may be accomplished without difficulty.

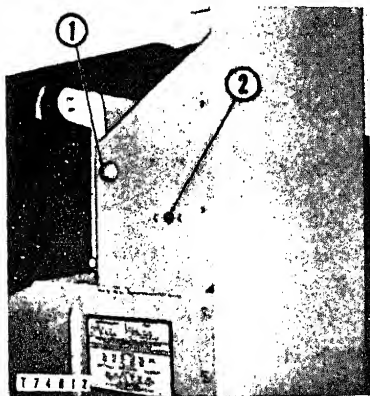
The battery terminal to be grounded is determined by the generator regulator. See the topic, GENERATOR REGULATOR.



Fuses: Motor graders are equipped with fuses, held in place by clips to a fuse block, in a metal box on the dash plate. The fuses protect attachment electrical components from damage in case of a short circuit.



FUSE BOX



CIRCUIT BREAKER

1-Horn switch. 2-Circuit breaker reset button.

CIRCUIT BREAKER

A circuit breaker (2) located to the left of the operator on the same panel as the horn switch (1), automatically breaks the circuit from the battery to the ammeter whenever an excessive load or a ground occurs within the electrical system.

If the circuit should be broken by the circuit breaker, the cause should be found and corrected before resetting the circuit breaker. To reset, push in the reset button.

Attachment Instructions

Attachments are available from your Caterpillar dealer. Many of these attachments will add to operator comfort and convenience as well as increase the usefulness of your motor grader.

CARE OF THE HYDRAULIC SYSTEM

The hydraulic system is designed to give long life when operated with clean oil.

Check the oil level every 10 service hours and fill if necessary. If the oil is low, make a thorough inspection of the hoses and connections for leaks. It should not be necessary to add oil if all the connections are tight and the hoses are in good condition. See the LUBRICATION INSTRUCTIONS for type of oil, draining, filter replacement and filling of the hydraulic system.

When operating in temperatures below freezing, see the OPERATION INSTRUCTIONS.

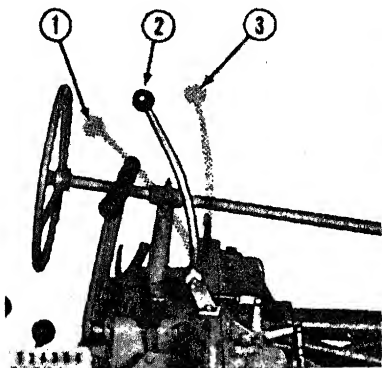
Hydraulic Steering Gear Booster: This steering gear is of the recirculating ball type to which has been added a hydraulic power system.

The principal working parts of the gear are the steering worm, the ball nut, the pitman shaft and sector, the control valve and hydraulic cylinder. The pump to supply oil pressure to the hydraulic steering booster is driven from the front of the power control worm.

In the event that the manual effort required to steer the motor grader becomes excessive, the hydraulic system comes into action automatically and relieves the driver of the excess load.

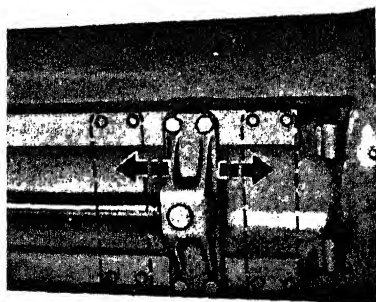
In addition to acting as a booster, the hydraulic system resists kicks backs or shocks. With this design steering "feel" has not been eliminated but has been reduced over the entire range of output, and the driver will continue to feel road reaction, obstructions, etc., the same as with mechanical gear except in reduced magnitude.

Hydraulic Power Blade: The side shift movement of the power blade is accomplished hydraulically and is controlled by a lever mounted forward of the power control. When it becomes necessary to side shift the blade, first lift the blade or position it so there is **no load** on the blade as it is shifted in the desired direction. To shift the blade to the left, push the control lever to the forward position (3), to shift it to the right, pull the control lever back to the rear position (1). Either position can be accomplished with the engine running at any speed. To hold the blade in the desired position, move the control lever to the hold position (2).



**POWER BLADE CONTROL
LEVER POSITIONS**

1-Rear position. 2-Hold position.
3-Forward position.



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SIDE SHIFT BAR BRACKET

When it is necessary for even longer than normal blade side shifts, remove the side shift bar bracket from the rails and move it in the desired direction, either to the right or to the left of the bar bracket mounting shown, to the next set of threaded holes in the rails.

SCARIFIER

Operating The Scarifier: In scarifying, the teeth should always penetrate the material and not be allowed to drag along the top of the surface as this causes undue wear on the points. Get a firm grip in the material to be torn up and work the teeth as deep as permitted by the job and by the available power.

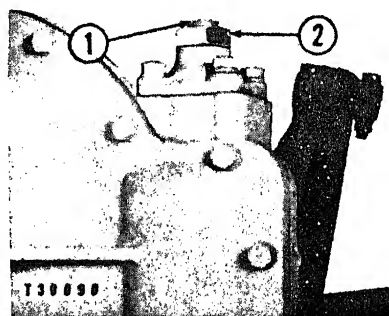
All eleven teeth can be used in scarifying soft materials. Extremely hard surfaces require the use of fewer teeth than can be used in soft materials. However, greater care must be exercised when part of the teeth are taken out, as this concentrates all of the load on the remaining teeth and greatly increases the danger of breakage. The use of fewer than six teeth in extremely heavy work is not advised.

It is not necessary to remove the scarifier block for ordinary ditch or bank work. It is desirable, however, in ditching to remove two or more of the teeth nearest to the point of the blade. If the reverse blade position is to be used, it is necessary to remove all teeth and adjust lift link to its shortest length. This will allow the end of the blade to pass under the block.

Worm Shaft Adjustment: Loosen the locknut (2) on the adjusting screw (1). Turn the screw in until it is tight, and then back off slightly and tighten the locknut.

WORM SHAFT ADJUSTMENT

1-Adjusting screw. 2-Locknut.

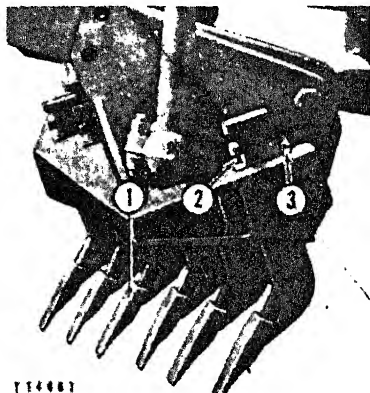


Tooth Length Adjustment: The portion of the tooth extending below the scarifier block may be varied by means of notches in the front edge of each tooth and a mating lug cast in the scarifier block. Earlier models have the notches in the back edge of each tooth and a mating lug cast in the scarifier block.

To remove a tooth or vary its working length, remove the locking pin

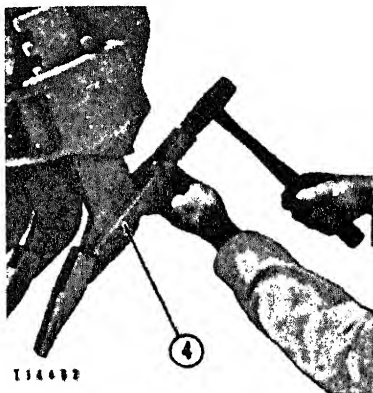
TOOTH LENGTH ADJUSTMENT

1-Replaceable tips. 2-Adjusting notches. 3-Locking pin.



This adjustment enables varying the tooth length to suit the type of material being worked.

Replaceable tips (1) for the scarifier teeth permit increased service being obtained from the teeth. When the tips become worn or damaged, they may be driven off and new ones installed. A tip removal tool (4) is furnished with each scarifier group.

**SCARIFIER TIP REMOVAL**

4—Tip removing tool.

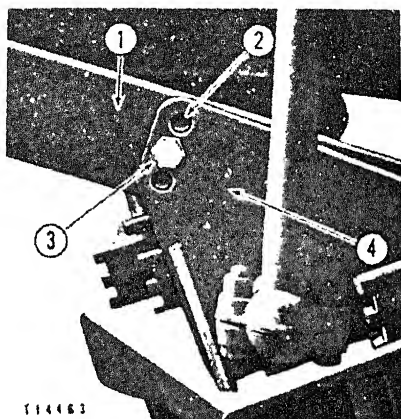


Tooth Pitch Adjustment: The pitch of the teeth may be varied to secure the best possible penetration for the type of material being scarified.

To vary the tooth angle, place the scarifier on the ground and remove

TOOTH PITCH ADJUSTMENTS

1-Drawbar. 2-Adjusting holes. 3-Bolt.
4-Side plates.



Some scarifier groups have adjusting links between the drawbar and scarifier, which permits this adjustment being made, rather than side plates. Adjustment is made in the same manner.

Washing Scarifier Housings: Remove the drain plugs and allow the old oil to drain thoroughly. Fill to the correct levels with kerosene; then operate the scarifier control for a few minutes. Drain the kerosene and fill with fresh oil.

APPENDIX A

GRADERSCRAPER OPERATING INSTRUCTIONS

General: The graderscraper is controlled by two auxiliary hydraulic controls and the motor grader lift and side shift controls. These permit the graderscraper to perform such tasks as opening V ditch on the first pass, cutting berms, sloping and back sloping and using cutting edge as a stinger.

Controls: Positioning of the graderscraper is brought about by the particular selection and movement of the hydraulic controls mentioned above. To maneuver the graderscraper into the following functions, select the associated lever positions indicated.

Apron Control is governed by a four-position hydraulic valve.

- a. Rear position - opens the apron
- b. Spring centered position - neutral
- c. Half forward position - forcibly closes apron
- d. Full forward position - apron float

Ejector Control is governed by a three-position hydraulic control.

- a. Rear position - moves ejector back for loading
- b. Center position - neutral
- c. Forward position - moves ejector forward to unload

Right and Left Lift Control is achieved thru the mechanical motor grader controls.

These controls operate simultaneously to raise or lower the graderscraper. Operated independently, lift controls tilt the bowl in the same manner the grader blade is tilted.

Side Shift Control is achieved thru the mechanical motor grader control.

This control operates in conjunction with lift arms in tilting or side shifting the graderscraper. By proper selection of the manual three-position bolt holes on the gooseneck, side shifting as much as 9 inches outside either wheel is possible.

Operating Procedure:

Load

Graderscraper loading time varies depending upon the material being loaded. In average material, a heaped load is obtained in 30 seconds, usually in less than two grader lengths. The graderscraper is a self-loading machine; completely eliminating jolts, shocks and the necessity of using a pusher. Drive wheels follow the cut and are always on firm ground.

Loading is normally done in first or second gear. If a light cut is being made, third or even fourth gear can be used.

Mud is easily loaded because drive wheels are on dry, firm ground. High production can be obtained by backing out of the cut.

The best apron position for fast, heap loading will vary according to looseness of material. Heavy material will roll in through a small apron opening, while loose material may require a wide open apron until the bowl is partially filled.

By experimenting with different apron positions, depths of cut, grader speeds, and tilt of bowl, a qualified operator will quickly find the right combination to rapidly load scraper.

Haul

The graderscraper gains peak yardage production on short or medium length hauls (up to 2000 feet). On longer hauls, bank yards per hour may decrease, but the cost per yard will still be less than that of much larger scrapers. There are three basic types of

ciency.

- a. Haul in reverse or reverse return trip. Best suited to short and medium haul or work in restricted area.
- b. Turn-around at each end of cycle. Best for long haul in a tight area.
- c. Continuous cycle, oval-shaped pattern. Best used for medium or long haul in open areas.

Take full advantage of the graderscraper reverse. Cut and haul in areas only 10 feet wide if necessary.

3. Dump

The graderscraper dumps fast and is an accurate spreading scraper. Motor grader controls permit precision spreads on level ground, rough terrain or slopes. Control of apron opening and ejector speed plus good operator visibility, allow smooth, accurate lifts.

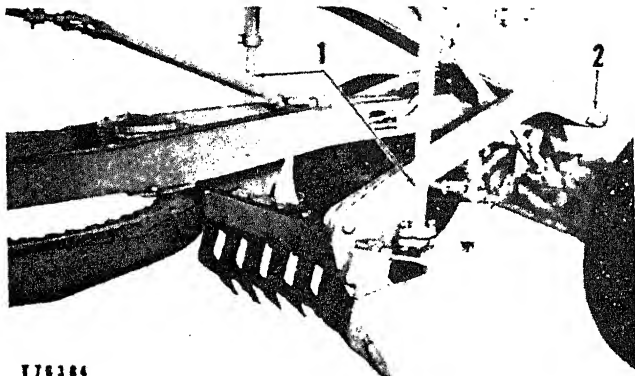
Loads can be ejected in forward or reverse.

Drive wheels are on firm footing because they follow the fill.

Stockpiling can be accomplished with the graderscraper by driving the front wheels to the top of the pile.

Blade to Graderscraper Changeover:

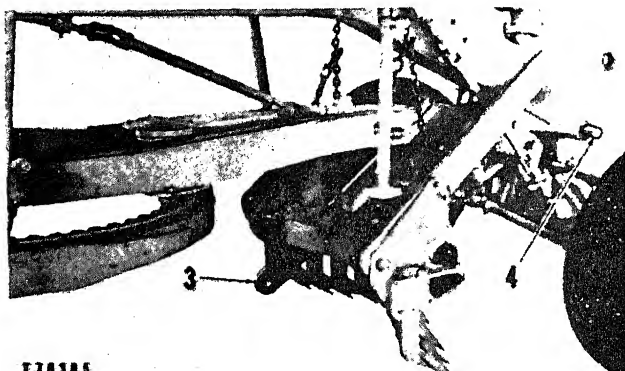
1. Select a firm and level area, large enough to allow space for the motor grader to maneuver. Drive motor grader onto site and lower the scraper blade and the scarifier.
2. Disconnect lift links (1) from the scarifier.
3. Attach lift chains and hoist to scarifier.



T76366

PREPARING TO REMOVE SCARIFIER

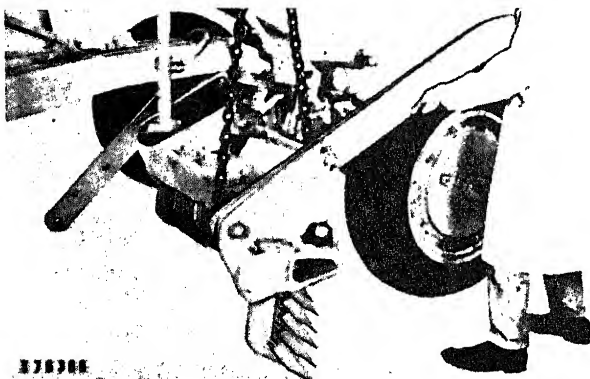
1-Lift links. 2-Collar.



T76365

SCARIFIER REMOVAL

3-Left drawbar arm. 4-Shaft.



T76368

REMOVING SCARIFIER

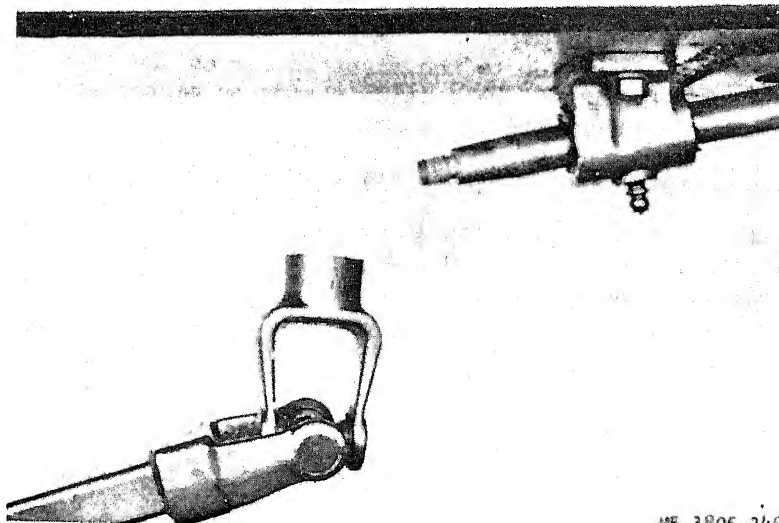
(3) to left side of scarifier.

5. Swing the scarifier to the right as far as the lift chains will allow. Reposition chains to center of scarifier and remove the scarifier.
6. Remove motor grader circle drive shaft below frame.
7. Disconnect the hydraulic lines (7) which lead to blade side shift cylinder. Couple lines to prevent dirt from entering system.
8. Remove 4 nuts which retain drawbar ball retaining cap (5).
9. Drive forward slowly until drawbar ball (6) disengages.
10. Lower drawbar ball to ground by operating lift arms.
11. Disconnect side shift (9) and lift ball (8) sockets at circle.
12. Drive off the blade.
13. Maneuver motor grader over the graderscraper.
14. Attach side-shift (11) and lift ball (10) sockets to graderscraper.

NOTE

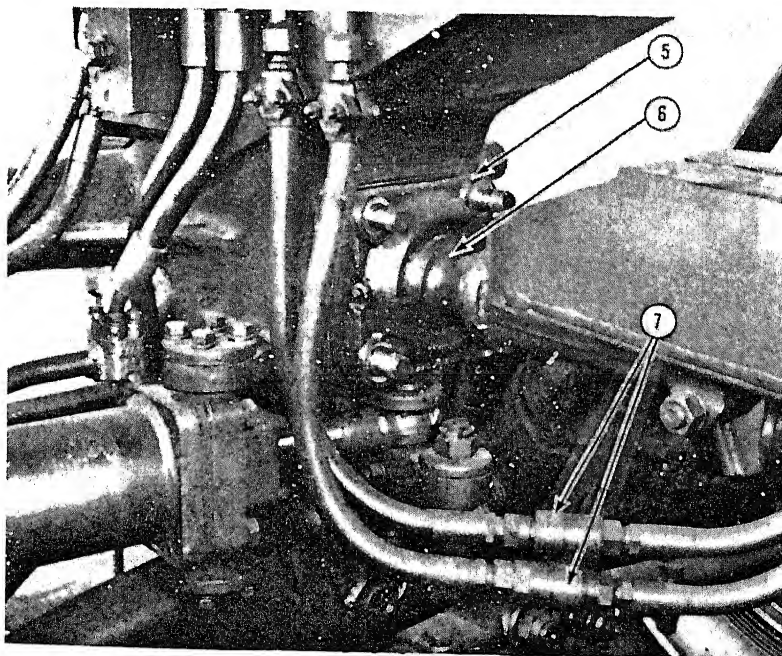
The ball joints for the tilt control (10) and side shift control (11) must be in the respective positions as shown below. If the graderscraper ball joints are not located in the proper mounting holes as shown, reverse hole positions. Be certain that the ball joints are not exchanged in the alteration process.

15. Back up slightly while operating lift and side shift controls to aline drawbar ball with socket.
16. Replace drawbar cap with the 4 retaining nuts and lock-washers.

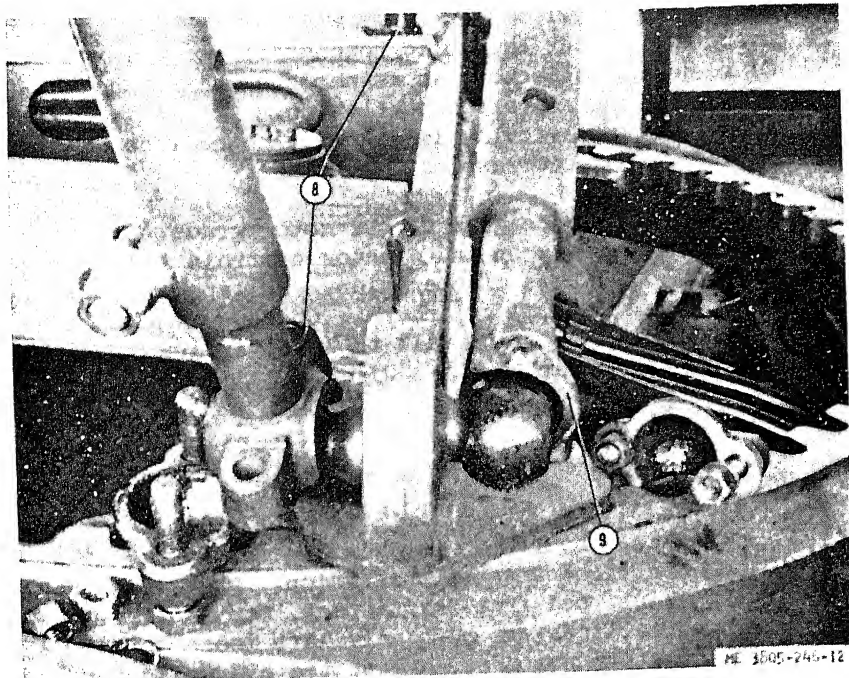


ME 3805-246

REMOVING CIRCLE DRIVE SHAFT



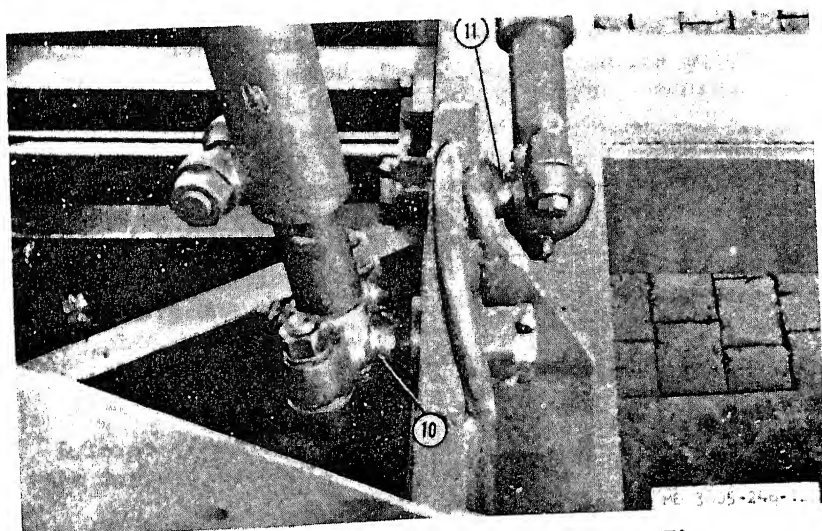
CIRCLE DRAWBAR BALL SOCKET



REMOVING CIRCLE LIFT AND SIDE SHIFT LINKS

8-Circle lift link and ball socket.

9 Side shift link and ball socket.



GRADERSCRAPER LIFT AND SIDE SHIFT BALL JOINTS

10-Tilt link ball joint. 11-Side shift link ball joint.

- Connect the four hydraulic hose quick couplers. Couple hose connectors in manner shown in grader-scraper front support installation. If hose couplings are numerically identified, connect hoses by matching their corresponding numbers.
- Start the diesel engine of the motor grader and manipulate the apron and ejector controls thru several complete cycles of operation. Collapse the apron and ejector control cylinders. Check hydraulic oil level in reservoir and fill to level indicated by lubrication order - IO 5-3805-246-12.
- Grease ball sockets and apron bearings.

NOTE

Check all hydraulic connections to be sure they are tight after installation. When this unit is shipped from the factory, many hydraulic connections are purposely left loose for installation purposes, except the hydraulic connections on the ejection cylinder, which is located inside the box bolted to the rear of the graderscraper. These connections are tight. Use sealing compound on pipe threads only.

On this equipment, several parts, such as bolts, pipe elbows and couplings, have been left unpainted purposely so that when the graderscraper installation is made the paint will not be destroyed. These various parts should be touched up after installation.

Scraper to Blade Changeover: Reverse procedures in steps 17 through 1 above. Reconnect hydraulic quick couplers to each other, both on motor grader and graderscraper to keep out dirt.

NOTE

Dirt Damages Hydraulics: Be extremely careful when disconnecting hydraulic lines to prevent dirt from entering system.

Experienced operators can accomplish the change-over in 40 minutes or less. A set of tools required for making the change is included and should be kept with the motor grader at all times.

Servicing the Graderscraper:

1. Check hydraulic oil level in reservoir tank DAILY whether or not the scraper is installed (Refer to Appendix D).
2. Grease bearings on each side of apron according to lubrication order-IO 5-3805-246-12.
3. Replace cutting edge and router bits when worn.

CAUTION

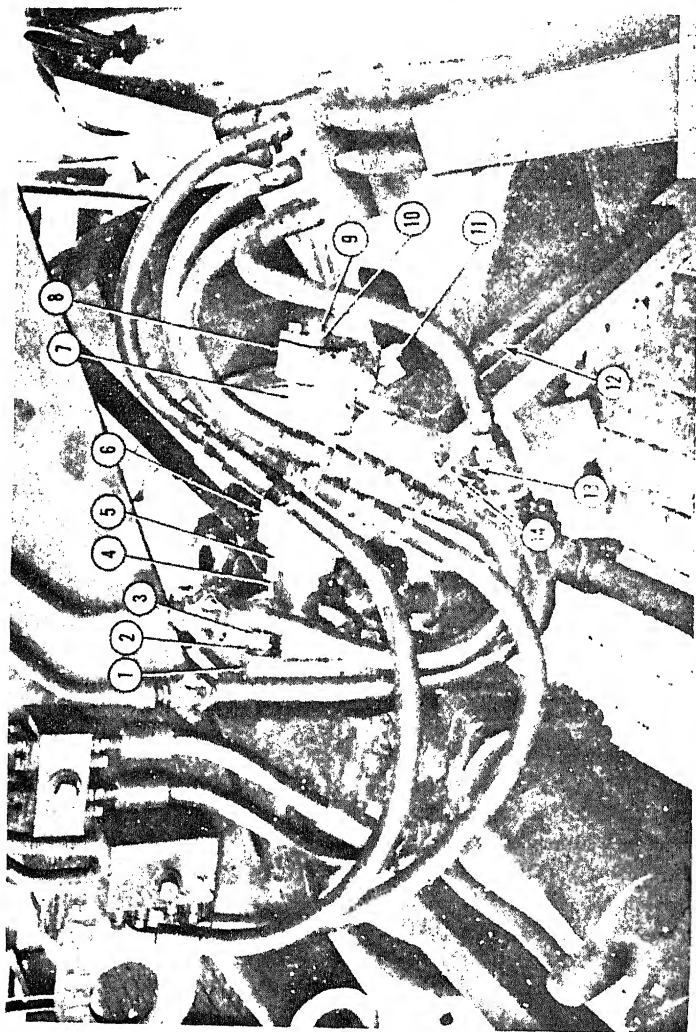
Excessive cutting edge wear will allow back-up blade to do cutting. This could result in serious damage to the scraper bowl.

GRADERSCRAPER INSTALLATION INSTRUCTIONS

General: These instructions are to be followed when installing a graderscraper on a motor grader not previously equipped with this attachment.

NOTE

All bolts, nuts, lockwashers, hose clamps, shims and loose parts necessary to assemble and install the graderscraper motor grader have been included in the installation kit supplied with the graderscraper. To eliminate lost or misplaced parts: All parts should be kept in a clean, central location until ready for installing.

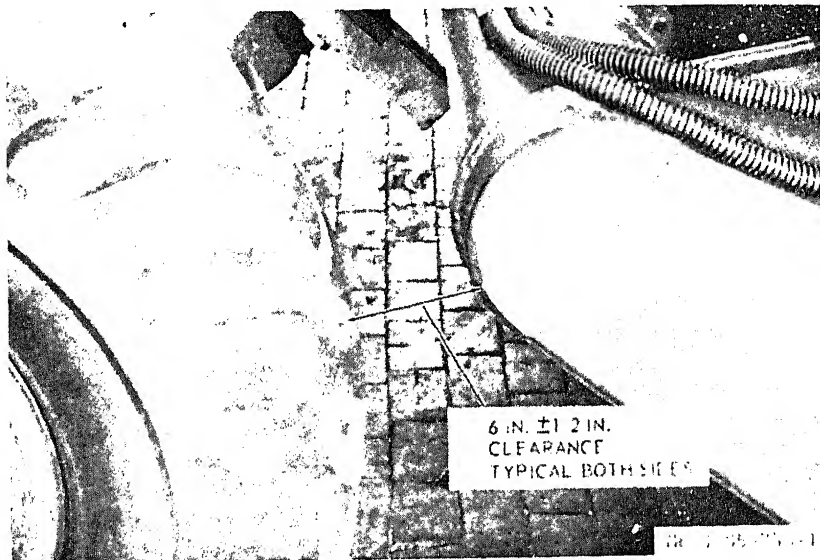


GRADERSCRAPER FRONT SUPPORT INSTALLATION

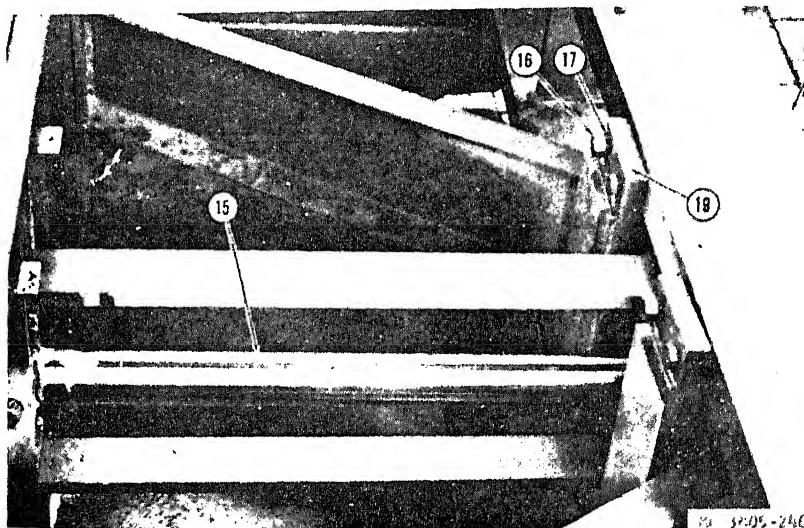
- 1-Drawbar ball retaining plate. 2-Lockwasher. 3-Nut. 4-Drawbar ball and shaft.
- 5-Spacer (Short). 6-Drawbar. 7-Spacer (Long). 8-2 inch nut. 9-Capscrew.
- 10-Lockwasher. 11-1-1/4 inch hex bolt. 12-Gooseneck. 13-Nut. 14-Lockwasher.

Assembly of the GS-55 Graderscraper:

1. Attach the drawbar (6) to the gooseneck (12) of the graderscraper with two 1-1/4 inch NF hex bolts (11), nuts (13), and lockwashers (14). Place the drawbar on the gooseneck so that the top hole in the drawbar contains the upper bolt.
2. Assemble the drawbar ball retaining plate (1) to the drawbar ball and attach the drawbar ball to the drawbar using spacers (5), (7) and the two inch NF nut (8). Normally the correct spacer adjustment is as shown, however this adjustment may vary according to tire size and tire wear on each motor grader. The final spacer position is determined by measuring the distance between the rear tread of the front tire and the front of the graderscraper (refer to illustration "Tire Clearance Adjustment"). The proper clearance is six inches $\pm \frac{1}{2}$ inch. Tighten nut (8) securely after correct spacer assembly has been established during graderscraper installation (refer to graderscraper changeover instructions). If nut (8) cannot be rotated due to interference with the top bolt (11), rotate drawbar ball shaft (4) while holding nut (8). Secure nut with two capscrews (9) and lockwashers (10).
3. Remove the protector plate that covers the ejector cylinder (15) and the ejector guide assembly (19). Remove the wood blocking between ejector guide assembly (19) and the reinforcing channels (18). Pull the ejector guide assembly (19) rearward until it is against the two eight inch reinforcing channels at rear of graderscraper. Bolt ejector guide assembly to the two reinforcing channels using eight 5/8 inch NF hex bolts, nuts (16) and lockwashers (17).
4. Install graderscraper on motor grader as described in blade to graderscraper changeover instructions.



PIPE CLEARANCE ADJUSTMENT



EJECTOR CYLINDER AND EJECTOR GUIDE ASSEMBLY

15-Ejector cylinder.

16-Nut

17-Lockwasher.

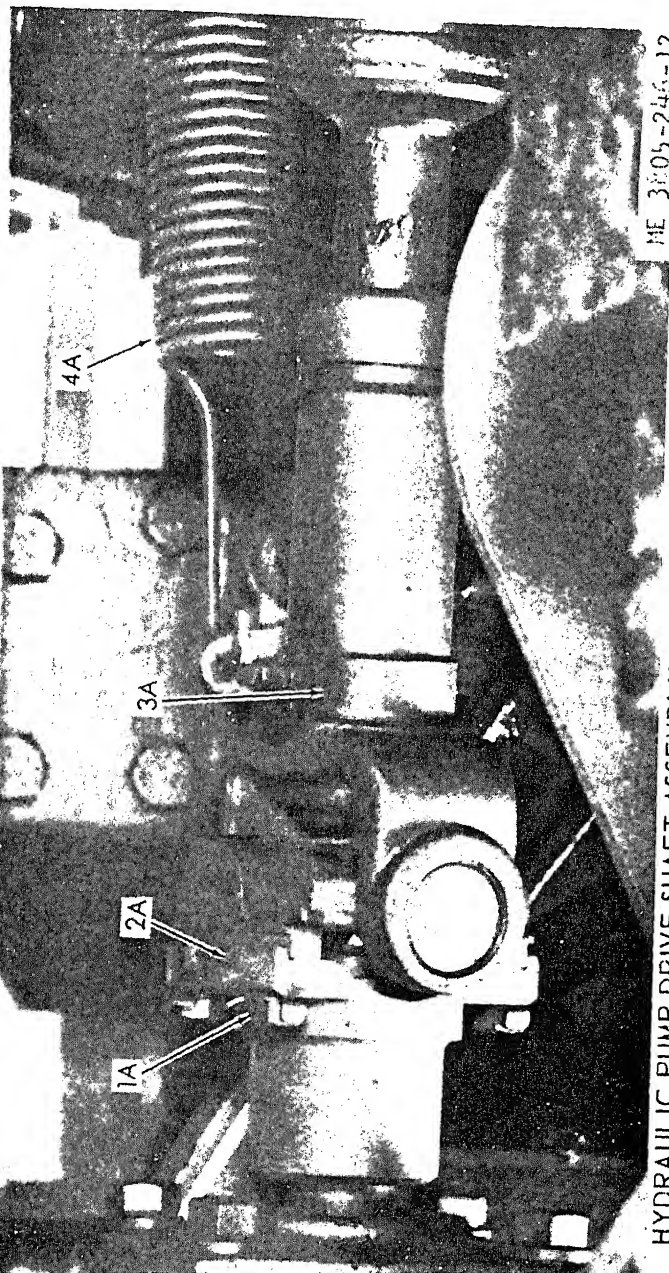
ASSEMBLY INSTRUCTIONS FOR
SEGMENTED MODEL NO. 112F MOTOR GRADER

General: The model no. 112F motor grader is designed that it may be delivered to a using organization either assembled or segmented. The following instructions pertain to the assembly of a motor grader delivered in segments (as for example; during an air drop).

1. Place the front portion of the motor grader on as level ground as possible. Extend jack pads to approximately $39\frac{1}{2}$ inches from the bottom face of the jack mounting supports. This is approximate height to align with rear position.
2. Place the rear portion of the motor grader as close and as nearly in line with the front portion as possible.
3. Roll the rear portion up to the front portion adjusting the height of the front portion until the dowel (11) will start into the flanges. Install the mounting bolts through the flanges and tighten. The top flange bolts are accessible through the doors (2) and (4) in the floor plates.
4. Install bolts that secure floor plates (1) to bracket (17), two bolts in holes (7) in the oil filter on the right side and single bolt in holes (6) on left side.
5. Go under the motor grader and install bolts (1A) to secure drive shaft to flange (15), (2A). The engine will have to be rotated to turn drive shaft (3A) so all bolts can be installed. Install clutch pedal return spring (16), (4A) and install arm (18) over door (5) on clutch pedal.
6. Install the rod end on the governor control rod (10) that extends past the flange and attach to the bellcrank (14). Install rod between bellcrank (14) and lever (12) on dash.
7. Install emergency brake bracket (3) to support (13).

left and right side of motor grader at floor plates.

8. Remove bolts (19) and (21) that secure tandems and store bolts in the storage holes (20) and (22).
9. Check all connections to make certain they are complete and tight.
10. Start engine and check operation of all components.
11. Refer to "Blade to Graderscraper Changeover Instructions" and install graderscraper on motor grader.

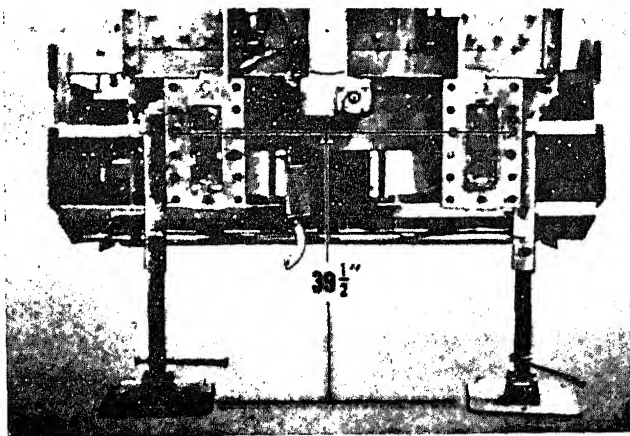


HYDRAULIC PUMP DRIVE SHAFT ASSEMBLY

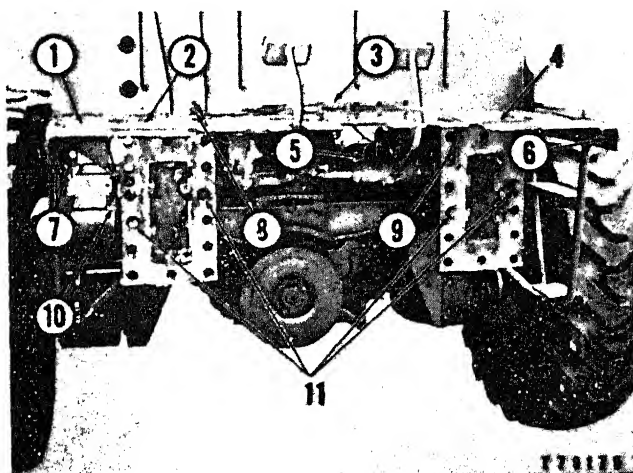
1A-Cap screw. 2A-Hydraulic pump coupling flange.

3A-Drive shaft.

4A-Clutch return spring.

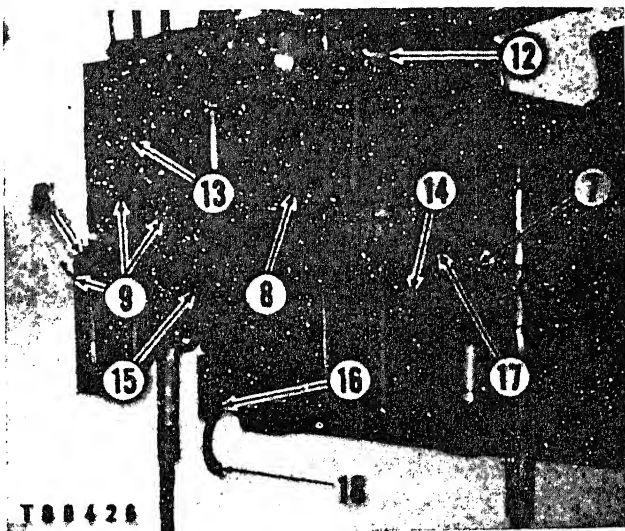


ADJUSTING HEIGHT OF FRONT
SECTION



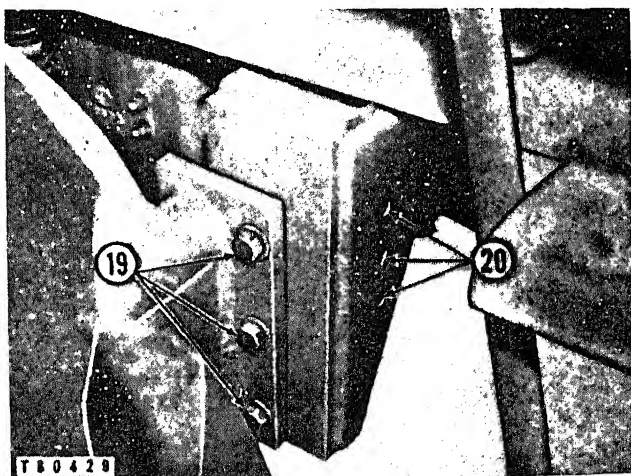
MOTOR GRADER ASSEMBLY

1-FLOOR PLATES. 2-DOOR. 3-EMERGENCY BRAKE
4-CONTROL LEVER. 5-ENGINE. 6-REAR WHEEL. 7-FRONT WHEEL. 8-FRONT AXLE. 9-REAR AXLE. 10-FRONT SUSPENSION. 11-FRONT WHEEL HUB.



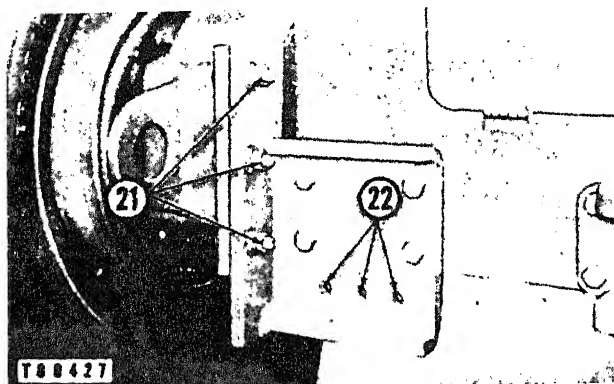
MOTOR GRADER ASSEMBLY

6-HOLE. 7-HOLES. 8-ELECTRICAL LEAD.
 9-ELECTRICAL LEAD. 12-LEVER. 13-SUPPORT.
 14-BELLCRANK. 15-FLANGE. 16-RETURN SPRING.
 17-BRACKET. 18-ARM.



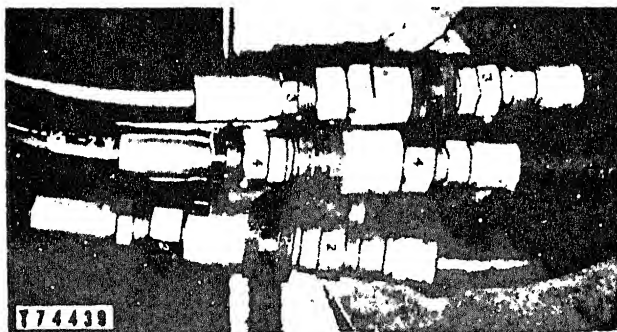
TANDEM LOCK BOLTS

19- BOLTS. 20-STORAGE HOLES.



TANDEM LOCK BOLTS

21-BOLTS. 22-STORAGE HOLES.



HOSE CONNECTIONS

This appendix lists items which accompany the Motor Grader or are required for installation, operation, or operator's maintenance.

BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

General: This Basic Issue Items List is divided into the following sections:

1. Basic Issue Items - Section II. This section is a listing of accessories, repair parts, tools, and publications required for operator's maintenance and operation, initially issued with, or authorized for the motor grader.
2. Maintenance and Operating Supplies - Section III. This section is a listing of maintenance and operating supplies required for initial operation.

Explanation of Columns: The following provides an explanation of columns in the tabular list of Basic Issue Items, Section II.

1. Source, Maintenance, and Recoverability Codes (SMR), Column 1:

- a. Source Code indicates the selection status and source for the listed item. Source code is:

Code

Explanation

P Applied to repair parts which are stocked in or supplied from GSA/DSA Army supply system, and authorized for use at indicated maintenance categories.

- b. Maintenance Code indicates the lowest category of maintenance authorized to install the listed item. The maintenance level code is:

- c. Recoverability Code indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability codes are:

Code	Explanation
R	Applied to repair parts and assemblies which economically reparable at DSU and GSU activities and are normally furnished by supply on an exchange basis.
T	Applied to high dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts are normally repaired or overhauled at depot maintenance activities.
U	Applied to repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, high dollar value reusable casings and castings.

2. Federal Stock Number, Column 2. This column indicates the Federal Stock Number for the item.
3. Description, Column 3. This column indicates the Federal item name and any additional description required. A five-digit manufacturer's or other service code is shown in parentheses followed by the manufacturer's part number. Repair parts quantities included in kits, sets, and assemblies that differ from the actual quantity used in the specific item are listed in parentheses following the repair part name.
4. Unit of Issue, Column 4. This column indicates the unit used as a basis of issue, e.g., ea, pr, ft, y etc.

5. Quantity Incorporated in Unit Pack, Column 5. This column indicates the actual quantity contained in the unit pack.
6. Quantity Incorporated in Unit, Column 6. This column indicates the quantity of the item used in the equipment.
7. Quantity Furnished with Equipment, Column 7. This column indicates the quantity of an item furnished with the equipment in excess of the quantity incorporated in the unit.
8. Quantity Authorized, Column 8. This column indicates the quantity of an item authorized the operator/crew to have on hand or to obtain as required. As required items are indicated with an asterisk.
9. Illustration, Column 9. This column is divided as follows:
 - a. Figure Number, column 9a, indicates the figure number of the illustration in which the item is shown
 - b. Item Number, column 9b, indicates the callout number used to reference the item in the illustration.

Explanation of Columns in the Tabular List of Maintenance and Operating Supplies - - Section III:

1. Item, Column 1. This column contains numerical sequence item numbers assigned to each component application to facilitate reference.
2. Component Application, Column 2. This column identifies the component application of each maintenance or operating supply item.
3. Federal Stock Number, Column 3. This column indicates the Federal Stock Number for the item and will be used for requisitioning purposes.

4. Description, Column 4. This column indicates the item and a brief description.
5. Quantity Required for Initial Operation, Column 5. This column indicates the quantity of each maintenance or operating supply item required for initial operation of the equipment.
6. Quantity Required for 8 Hours Operation, Column 6. This column indicates the estimated quantities required for an average eight hours of operation.
7. Notes, Column 7. This column indicates informative notes keyed to data appearing in a preceding column.

Federal Supply Code for Manufacturers

Code	Manufacturer
11083	Caterpillar Tractor Co. Peoria, Illinois
29206	Martin Company Kewanee, Illinois

SECTION II

BASIC ISSUE ITEMS LIST

(1) SOURCE, MAINT, AND REC'D CODE			(2) FEDERAL STOCK NO.	(3) DESCRIPTION	(4) UNIT OF ISSUE	(5) QTY INC IN UNIT PACK	(6) QTY FURN IN UNIT	(7) QTY WITH EQUIP	(8) QTY AUTH	(9) ILLUSTRATION	
(A)	(B)	(C)								(A)	(B)
S	M	R								FIG NO.	ITEM NO.
				GROUP 31 - BASIC ISSUE ITEMS MANUFACTURER INSTALLED							
P	C		7510-889-3494	3100-BASIC ISSUE ITEMS, MANUFACTURER OR DEPOT INSTALLED				1	1		
P	C		7520-559-9618	BINDER: LOOSE LEAF: U. S. Army equip- ment logbook CASE: Maintenance and Operational Manuals, cotton duck, water-repellent, mildew-resistant, MII-B-11743B	EA			1	1		
				DEPARTMENT OF THE ARMY LUBRICATION ORDER IO 5-3805-246-12-1 thru 4.	EA			1	1		
				DEPARTMENT OF THE ARMY ORGANIZATIONAL MAINTENANCE MANUAL TM 5-3805-246-12	EA			1	1		
P	C		4210-889-2221	EXTINGUISHER, FIRE, DRY CHEMICAL: Hand type, 2-1/2 lbs. stored pressure, 1 wall bracket	EA			1	1		
				GROUP 32 - BASIC ISSUE ITEMS, TROOP INSTALLED							
				3200-BASIC ISSUE ITEMS, TROOP INSTALLED OR AUTHORIZED							
P	C		5120-240-8703	ADAPTER: 3/8 in. to 1/2 in. (11083) 8H8576	EA			2	2		

SECTION II

BASIC ISSUE ITEMS LIST

(1) SOURCE, MAINT. AND REC'D CODE			(2) FEDERAL STOCK NO.	(3) DESCRIPTION	(4) UNIT OF ISSUE	(5) QTY INC IN UNIT PACK	(6) QTY INC IN UNIT	(7) QTY FURN WITH EQUIP	(8) AUTH	(9) ILLUSTRATION	
(A)	(B)	(C)								(A) FIG NO.	(B) ITEM NO.
S	M	R									
P	C		5120-224-1389	BAR, PINCH (11083) 5F4764	EA			2	2		
P	C			EYE, LIFT: (11083) 3R1938	EA			2	2		
P	C		5120-293-0887	HAMMER, SLEDGE	EA			2	2		
P	C		5120-652-3665	HANDLE: 3/4 in. sq. drive (11083) 8H8547	EA			2	2		
P	C		5120-293-0987	HEAD, RATCHET: 3/4 in. sq. drive (11083) 8H8545	EA			2	2		
P	C		5315-682-1597	PIN-SHEAR (11083) 2D5511	EA			2	2		
P	C		5110-595-9490	PLIERS (11083) 2R8497	EA			12	12		
P	C		5120-240-5364	RATCHET: 3/8 in. sq. drive (11083) 8H8572	EA			2	2		
P	C		5120-020-2360	SCREWDRIVER (93389) 9842	EA			2	2		
P	C		5120-189-7932	SOCKET: 9/16 in.; 1/2 in. sq. drive. (11083) 8H8549	EA			2	2		
P	C		5120-189-7985	SOCKET: 3/4 in.; 1/2 in. sq. drive (11083) 8H8552	EA			2	2		
P	C		5120-242-3354	SOCKET: 7/16 in.; 1/2 in. sq. drive (11083) 8H8562	EA			2	2		

SECTION II

BASIC ISSUE ITEMS LIST

(1) SOURCE, MAINT, AND REC'D CODE			(2) FEDERAL STOCK NO.	(3) DESCRIPTION	(4) UNIT OF ISSUE	(5) QTY INC IN UNIT PACK	(6) QTY INC IN UNIT	(7) QTY FURN WITH EQUIP	(8) QTY AUTH	(9) ILLUSTRATION	
(A)	(B)	(C)								(A)	(B)
S	M	R								FIG NO.	ITEM NO.
P	C		5120-189-7935	SOCKET: 15/16 in.; 1/2 in. sq. drive (11083) 8H8555	EA			2	2		
P	C		5120-239-0021	SOCKET: 1-1/8 in.; 3/4 in. sq. drive (11083) 8H8534	EA			2	2		
P	C		5120-232-5681	SOCKET: 1-5/16 in.; 3/4 in. sq. drive (11083) 8H8536	EA			2	2		
P	C		5120-228-9505	WRENCH, COMBINATION: 7/16 in. (11083) 8H8506	EA			2	2		
P	C		5120-228-9507	WRENCH, COMBINATION: 9/16 in. (11083) 8H8508	EA			2	2		
P	C		5120-228-9510	WRENCH, COMBINATION: 3/4 in. (11083) 8H8511	EA			2	2		
P	C		5120-228-9513	WRENCH, COMBINATION: 15/16 in. (11083) 8H8514	EA			2	2		
P	C		5120-228-9515	WRENCH, COMBINATION: 1-1/16 in. (11083) 8H8516	EA			2	2		
P	C		5120-228-9516	WRENCH, COMBINATION: 1-1/8 in. (11083) 8H8517	EA			2	2		
P	C		5120-228-9518	WRENCH, COMBINATION: 1-5/16 in. (11083) 8H8519	EA			2	2		

MAINTENANCE AND OPERATING SUPPLIES

(1) ITEM	(2) COMPONENT APPLICATION	(3) FEDERAL STOCK NUMBER	(4) DESCRIPTION	(5) QUANTITY REQUIRED F. INITIAL OPERATION	(6) QUANTITY REQUIRED F. 8 HRS OPERATION	(7) NOTES
1	0101 Crankcase (1)	9150-680-1106 9150-680-1103 9150-242-7604	OIL, LUBRICATING: 55 gal. drum as follows: HDO-30 (2) HDO-10 (2) OES (2)	21 qt (1) 21 qt (1) 21 qt (1)	{3} {3} {3}	(1) Includes quantity of oil to fill engine oil system as follows: 18 qt diesel engine 3 qt starting engine
2	0306 Tank Fuel	9140-286-5294 9140-286-5286	FUEL OIL, DIESEL: Bulk as follows: Regular grade (DF2) (2) Winter grade (DF1) (2)	60 gal (4) 60 gal (4)	{32 gal (5) 32 gal (5)}	(2) See C9100III for additional data and requisitioning procedure.
3	0306 Tank Fuel	9130-160-1818 9130-160-1830	FUEL, GASOLINE: Bulk as follows: Automotive, combat (91A) (2) Automotive, combat (91C) (2)	2 gal (4) 2 gal (4)		(3) See current LO for grade application and replenishment intervals
4	0501 Radiator		WATER ANTIFREEZE: 55 gal. drum as follows: Ethylene glycol Compound Arctic	36 qt (4) 18 qt 36 qt		(4) Tank capacity (5) Average fuel consumption is 4 gal per hour
5	0700 Transmission and rear axle housing	6850-664-1409 6850-174-1806 9150-577-5845 9150-257-5442	LUBRICATING OIL GEAR: 55 gal drum as follows: GO-90 (2) GO-S (2)	54 qt 54 qt	{3} {3}	(6) Use oil as prescribed in item 5 (7) Use oil as prescribed in item 9

SECTION III

MAINTENANCE AND OPERATING SUPPLIES

(1) ITEM	(2) COMPONENT APPLICATION	(3) FEDERAL STOCK NUMBER	(4) DESCRIPTION	(5) QUANTITY REQUIRED F. INITIAL OPERATION	(6) QUANTITY REQUIRED F. HRS. OPERATION	(7) NOTES
6	1004 Leaning Wheel Control Housing		LUBRICATING OIL GEAR: (6) OO-90 OO-S	3 pt 3 pt	(3) (3)	
7	1105 Tandem Drive Housing		LUBRICATING OIL GEAR: (6) OO-90 OO-S	24 qt. ea. 24 qt. ea.	(3) (3)	
8	1204 Hydraulic Brake System	9150-231-9071 9150-252-6375	HYDRAULIC FLUID: 1 gal. can as follows: HB (2) HBA (2)	1 qt 1 qt	(3) (3)	
9	1401 Steering Gear Housing	9150-265-9435 9150-265-9428 9150-242-7603	OIL LUBRICATING: 5 gal. drum as follows: OE-30 (2) OE-10 (2) OE-S (2)	3/4 qt 3/4 qt 3/4 qt	(3) (3) (3)	
10	2002 Power Con- trol, Shaft & Gear Housing		LUBRICATING OIL GEAR: (6) OO-90 OO-S	9-1/2 qt 9-1/2 qt	(3) (3)	
11	4308 Hydraulic System		OIL LUBRICATING: OE-10 (7) OE-S	18 qt 18 qt	(3) (3)	
12	7439 Blade Lift Control Housing		LUBRICATING OIL GEAR: (6) OO-90 OO-S	2 qt ea 2 qt ea	(3) (3)	

SECTION III

MAINTENANCE AND OPERATING SUPPLIES

(1) ITEM	(2) COMPONENT APPLICATION	(3) FEDERAL STOCK NUMBER	(4) DESCRIPTION	(5) QUANTITY REQUIRED F. INITIAL OPERATION	(6) QUANTITY REQUIRED F. & HRS OPERATION	(7) NOTES
13	7439 Circle Reverse Con- trol Housing		LUBRICATING OIL GEAR: (6) GO-90 GO-S	1-1/2 qt 1-1/2 qt	(3) (3)	
14	7439 Circle Shift Control Housing		LUBRICATING OIL GEAR: (6) GO-90 GO-S	1 qt 1 qt	(3) (3)	
15	7441 Scarifier Control Upper Housing		LUBRICATING OIL GEAR: (6) GO-90 GO-S	6-1/2 qt 6-1/2 qt	(3) (3)	
16	7441 Scarifier Control Lower Housing		LUBRICATING OIL GEAR: (6) GO-90 GO-S	1 qt 1 qt	(3) (3)	
17		9150-190-0902	GREASE AUTOMOTIVE AND ARTILLERY: (3) 5 lb can as follows: GAA (2)			

This appendix provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

General: Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

Explanation of Columns in Section II:

1. Group Number. Column 1. The functional group is a numerical group set up on a functional basis. The applicable functional grouping indexes (obtained from TB 750-93-1, Functional Grouping Codes) are listed on the MAC in the appropriate numerical sequence. These indexes are normally set up in accordance with their function and proximity to each other.
2. Functional Group. Column 2. This column contains a brief description of the components of each functional group.
3. Maintenance Functions. Column 3. This column lists the various maintenance functions (A through K) and indicates the lowest maintenance category authorized to perform these functions. The symbol designations for the various maintenance categories are as follows:

- C - Operator or crew
- O - Organizational maintenance
- F - Direct support maintenance
- H - General support maintenance
- D - Depot maintenance

- A - INSPECT. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.
- B - TEST. To verify serviceability and to detect electrical or mechanical failure by use of test equipment.
- C - SERVICE. To clean, to preserve, to charge, to paint, and to add fuel, lubricants, cooling agents, and air.
- D - ADJUST. To rectify to the extent necessary to bring into proper operating range.
- E - ALIGN. To adjust specified variable elements of an item to bring to optimum performance.
- F - CALIBRATE. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.
- G - INSTALL. To set up for use in an operational environment such as an emplacement, site, or vehicle.
- H - REPLACE. To replace unserviceable items with serviceable assemblies, subassemblies, or parts.
- I - REPAIR. To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.
- J - OVERHAUL. To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards using the Inspect and Repair Only as Necessary (IROAN) technique.
- K - REBUILD. To restore an item to a standard as nearly as possible to original or new condition in appear-

through complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerances and specifications, and subsequent reassembly of the item.

4. Tools and Equipment. Column 4. This column is provided for referencing by code the special tools and test equipment, (Section III) required to perform the maintenance functions (Section II).
5. Remarks. Column 5. This column is provided for referencing by code the remarks (Section IV) pertinent to the maintenance functions.

Explanation of Columns in Section III:

1. Reference Code. This column consists of a number and a letter separated by a dash. The number references the T&TE requirements column on the MAC. The letter represents the specific maintenance function the item is to be used with. The letter is representative of columns A through K on the MAC.
2. Maintenance Category. This column shows the lowest level of maintenance authorized to use the special tool or test equipment.
3. Nomenclature. This column lists the name or identification of the tool or test equipment.
4. Tool Number. This column lists the manufacturer's code and part number, or Federal Stock Number of tools and test equipment.

Explanation of Columns in Section IV:

1. Reference Code. This column consists of two letters separated by a dash, both of which are references to Section II. The first letter references column 5 and the second letter references a maintenance function, column 3, A through K.

2. Remarks. This column lists information pertinent to the maintenance function being performed, as indicated on the MAC, Section II.

SECTION II - MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS										(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K	
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD	
01	ENGINE, STARTING												
0100	Engine Assembly	C	F	C				F	F	F	H		A
0101	Crankcase, Block, Cylinder Head:												
	Block								H	H			
	Head, cylinder								F	F			
0102	Crankshaft								H	D			
0103	Flywheel Assembly								H	H			
0104	Pistons, Connecting Rods	H							H	H			B
0105	Valves, Camshaft & Timing System:												
	Arm, rocker	F			F				F				
	Camshaft	H							H				
	Cover & Gasket	O							O				

SECTION II - MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
0105	Valves, Camshaft & Timing System: (Continued) Gear & chain, timing Valves	H							H	F				C
0106	Engine Lubricating System: Filter assembly Pan, oil; pump, oil; valve, bypass; valve, pressure regulating			C					O					
02	CLUTCH	H							H	H				
0200	Clutch Assembly				O				H	H				
0202	Clutch Release Mechanism	H							H	H				
0207	Clutch Brake Plate	H							H					

SECTION II - MAINTENANCE ALLOCATION CHART

(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
	A	B	C	D	E	F	G	H	I	J	K		
	INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
FUEL SYSTEM:													
1 Carburetor				O				O	F		F		
4 Air Cleaner			C					O					
5 Tanks, Lines, Fittings			C					O	O				
3 Engine Speed Governor and Controls:	C												
Governor assembly				O				H	H				
Linkage, rod								F	F				
EXHAUST SYSTEM													
1 Muffler & Pipes	C							O					
COOLING SYSTEM													
3 Water Manifold, Headers, Pipe, External	C							F	F				

SECTION II - MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS												(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K			
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD			
06	ELECTRICAL SYSTEM														
0603	Starting Motor	O							O	O	F			D	
0605	Ignition Components:														
	Magneto	O							O	H					
	Spark plug	O			O				O						
	Wires	C							O	O					
0612	Batteries	C		O					O						

SECTION II - MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
01	ENGINE, DIESEL													
0100	Engine assembly	C	F	C										
0101	Crankcase, Block, Cylinder Head							H	H	H	D			A
	Block	D							D	D				
	Head, cylinder	F							F	H				
0102	Crankshaft; Crankshaft													
	Pulley, crankshaft								D	D				
0103	Flywheel Assembly	F							F					
0104	Pistons, Connecting Rods								H	H	H			B

SECTION II - MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
0105	Valves, Camshaft, & Timing System:	INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
	Arm, rocker								F	H				
	Camshaft	H			O				H					
	Cover and gasket								O					
	Gears, timing								H					
	Valves	H							F	H				C
	Engine Lubrication System:													
0106	Breather								O					
	Cooler, oil								F	H				
	Filter assembly, oil								F					
	Pan, oil								F	F				
	Pump, oil								H	H				

SECTION II - MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
0106	Engine Lubrication System: (Continued) Valve, bypass Valve, pressure regula- ting	INSPECT	H		SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD	
0108	Manifolds	F									H			
0109	Accessory Drive Mechanism		H						H		H			
02	CLUTCH													
0200	Clutch Assembly			C						H	H			
0202	Clutch Release Mechanism Pedal, linkage Yoke, shaft, bearings				O									
0207	Clutch Brake Hub, Plate	H							F	H	H			
03	FUEL SYSTEM	H												

SECTION II - MAINTENANCE ALLOCATION CHART

(1)	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS										(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K	
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD	
01	Fuel Injector		H						F	H			
02	Fuel Pump								F	H			
	Pump fuel transfer		O						F	H			
	Pump, fuel injection			C		H			F	H			
04	Air Cleaner												
	Cleaner, air, precleaner			C					O				
05	Turbocharger								F	H			
06	Tanks, Lines, Fittings;								F				
	Tank, fuel	C		C					F	F			
08	Engine Speed Governor and Controls												
	Governor assembly				F				F	H			
	Linkage, rod				F				F				

SECTION II - MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
0309	Fuel Filters; Filters, fuel; strainer			O					F					
0312	Throttle Control				O				F	F				
04	EXHAUST SYSTEM													
0401	Exhaust System	O							F					
05	COOLING SYSTEM													
0501	Radiator	C	F	C					F	H				
0503	Water Manifold Headers, Thermostat, Housings		O						O					
0504	Water Pump								F	H				
0505	Fan Assembly:													
	Belt	C			O				O					
	Hub assembly								F	F				

SECTION II - MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
06	ELECTRICAL SYSTEM													
0601	Generator													
	Belt	C			O				O					
	Generator		O						O	O	F			E
0602	Generator Regulator		O		O				O	F				
0607	Instrument Panel													
	Gages													
	Switches	C							F					
	Lights	C							F					
	Wiring	C							O					
	Miscellaneous Item.								O	O				
0608	Light switch		C						F					
	Wiring								O					

SECTION II - MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS										(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K	
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD	
0609	Lights								O	O			
0611	Horn								F	O			
0613	Chassis Wiring Harness								F	O			
07	TRANSMISSION												
0700	Transmission Assembly								H	H	D		
0701	Transmission Shafts												
	Shafts, gears, bearings, seals								D				
0702	Opposed Output:												
	Gears, pinions, shafts, shims, cover								D				

SECTION II - MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
0704	Transmission Top Cover Assembly Shifter; levers; forks; shafts, seals Linkage, levers Coolers, Pumps, Motors: Filter, oil cooler Pump FRONT AXLE	D							D	D				
0721		O	O						O					
10		H							H	H				
1001	Front Axle Assembly	C		O					H	H				
1004	Steering and Wheel Leaning Mechanism Gear box assembly Knuckles; arms; shafts Shafts, control, universal joints								F	F		H		
			O	O					H					
			O						F					

SECTION II - MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
11	REAR AXLE													
1105	Tandem Drive Assembly	O		O	H				D	D				
12	BRAKES													
1201	Hand Brake													
	Band, linkage, internal				O				F	F				
	Lever, rod, linkage								F	F				
	Drum								F	H				
1202	Service Brake	O			O				F	F	H			
1204	Hydraulic Brake System													
	Cylinder assembly, master	C		O					F	H				
	Cylinder assembly, wheel								F	H				
1206	Mechanical Brake System Pedal and Linkage				O				F					

SECTION II - MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS										(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K	
13	WHEELS AND TRACKS	INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD	
1311	Wheel Assembly												
	Bearings	O		O					F				
	Drums								F	H			
	Wheel, rim, seal, studs	O							O				
1313	Tires:												
	Tires	C							O	O			
14	STEERING:												
	Steering Assembly												
	Link, drag; rod, tie				F								
	Steering gear assembly	C		O	F				F	F			
	Wheel, steering	C							F				
1411	Hoses, Lines, Fittings	C							F				

SECTION II - MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS										(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K	
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD	
1412	Hydraulic Cylinders	C							F	H			
1414	Steering System Valves								F	F			
	Relief valve												
15	FRAME, TOWING ATTACHMENTS AND DRAWBARS												
1501	Frame Assembly								H	H			
1503	Pintles & Towing Attachments Pin	O							O				
16	HOOD AND HULL												
1801	Hood	O							F				
1805	Floors	O							F	H			
1806	Seats				O				F	H			
1808	Stowage Boxes												
	Box, tool								F	F			

SECTION II - MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
20	POWER CONTROL UNIT													
2002	Power Control Unit Assembly													
	Control assembly	C		C					F	F	H			
	Pin, shear	O							O					
	Shaft, propeller	C		C					F	F				
22	ACCESSORY ITEMS													
2210	Data and Instruction Plates	O							F					
42	ELECTRICAL EQUIPMENT													
4210	Ammeter	C							F					
43	HYDRAULIC SYSTEM													
4301	Filters, Hoses	C		O					F					
4302	Pump & Pump Drives	F							F	H				

SECTION II - MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
4305	Manifold and Control Valve													
	Control valve													
	Relief valve								F	H				
4307	Hydraulic Cylinders	F							F	H				
4308	Liquid Tank or Reservoirs								F	H				
47	GAGES: MEASURING DEVICES			C					F	F				
4702	Gages	C							O					
4703	Hourmeter	O							F					
74	EARTH MOVING EQUIPMENT COMPONENTS													
7435	Moldboard Assembly	C			O				F	O				F
7436	Lift Arms & Pivot Assemblies	C		C					O	F				

SECTION II - MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
7438	Circle & Drawbar Assembly	C		C	O			C	F	F			1	G
7439	Circle Reverse Drawbar Side Shift & Lift Mechanism:													
	Gear case assembly	C		C					F	F				
	Joints, universal			C				F						
7440	Scarifier Assembly:													
	Scarifier assembly	C		C	O				F	O	F			H
7441	Scarifier, Actuating	C		C					F	F				
76	FIRE FIGHTING EQUIPMENT													
7603	Fire Extinguisher			C					O					

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
43	GS55 GRADERSCRAPER													
	HYDRAULIC SYSTEM													
4301	Hose, Fittings								F					
4307	Hydraulic Cylinders								F	H				
74	EARTH MOVING EQUIPMENT COM- PONENTS													
7444	Main Body			C					F					
7448	Bowl & Discharge Components			C					F					

**Section III. SPECIAL TOOL AND SPECIAL TEST
EQUIPMENT REQUIREMENTS**

REFERENCE CODE	MAINTENANCE LEVEL	NOMENCLATURE	TOOL NUMBER
1-G	C	Wrench, Draft-Bolt	(29206 06-503

REFERENCE CODE	REMARKS
A - I	Test includes operation and compression.
B - I	Repair of flywheel includes replacing ring gear.
C - I	Repair of valves includes refacing seats.
D - I	Repair of starter includes replacement of brushes and solenoid assembly only.
E - I	Repair of generator includes replacement of brushes only.
F - I	Repair of blade includes replacing bits and cutting edge only.
G - G	Install graderscraper drawbar.
H - I	Repair of scarifier includes replacing teeth only.

HAROLD K. JOHNSON,
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Chief of Staff.

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KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

DISTRIBUTION:

To be distributed in accordance with DA Form 12-25, Section II, Organizational Maintenance Requirements for Earth Moving Equipment, Graders.

